# ELECTRICAL CONSTRUCTION AND MAINTENANCE

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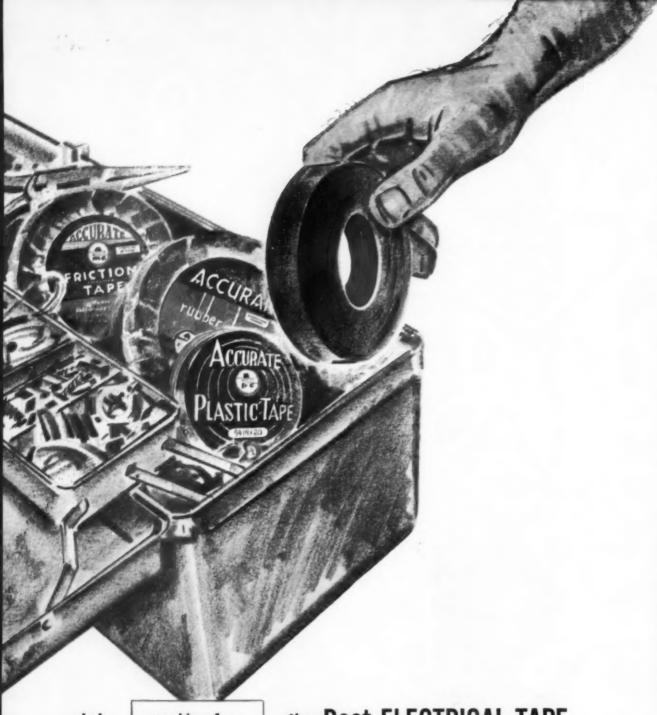


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# Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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# Sidelights.

ESTIMATIC—If you've ever burned off-peak kwh into the small hours working out the interminable summaries, listings, pricing, extension and miscellaneous figure work between the take-off and recapitulation of a large estimate, you'll be interested in the procedures of an estimator at Sturgeon Electric Co. in Denver. His take-off is a relatively brief list of quantities and cryptic code numbers. He hands it along to a machine room from which it emerges in a few minutes all tabulated, priced, extended and totalled. Estimatic, they call it. Uncanny, we call it. See page 87.

STATISTICAL SUMMARY-Our annual statistical summary, compiled by B. C. Cooper, again brings together source data from many aspects of the economy, of construction, and of the electrical industry. It is prepared to provide our readers with the pertinent bench marks, guide lines and trends which affect their business and their business opportunities. More and more business organizations, large and small are charting their own progress, planning ahead and setting up objective goals. Whether plans are short range or long, whether they are general targets or tied to firm budgets it is important to know how they relate to the broad growth patterns of the industry. "Planning Your 1957 Proggram", page 91, discloses the major trends. The editors welcome suggestions from our readers as to any additional data desired that would help to make this service more useful to you.

PROPOSALS-Favorable comments from readers on Ray Ashley's, "Proposals for Electrical Installations" last month indicate that our industry authority on estimating practice has hit upon a sensitive and timely theme. He recommends a thorough disclosure of all considerations that are practical and relevant to the project. In marketing parlance, the proposal is a point-of-role contact. Its content can inspire confidence and interest or indifference on the part of the buyer. It can leave him with a hard decision to make or it can give him factual grounds for favorable consideration. Ashley pursues the subject further in a second article of the series on page 111.

SPECIAL TRUCKS—Trucks play an important role in modern electrical work and in recent years the demand for specialized bodies and equipment has been rising steeply. Besides "cartage", the contractor truck may provide a portable power shop, a rolling stock-room, or a plush, fluorescent lighted, air conditioned and electrically heated engineering office. These

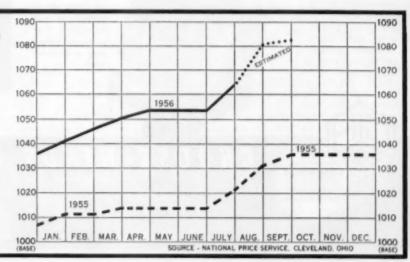
innovations have one primary goalto give better service. Several examples of special truck designs and uses are described in "Speed Service with Special Trucks", beginning on page 114.

EMERGENCY POWER-Modern hospital equipment is so heavily dependent upon an uninterrupted energy supply that some form of emergency power must be available. M. L. Beeson, Electrical Engineer, County of Los Angeles and P. Belsky, switchgear engineer. Westinghouse describe in "Emergency Electrical Service for Hospitals", page 116, a system providing positive power protection for polio respirator patients. Two diesel generator sets are operated in parallel, automatically regulated. Load transfer is initiated either by interruption of utility service or by sustained low voltage.

MULTIPLE SYSTEMS—Plant power needs at the new 4½ million dollar office and factory of Electric Controller and Manufacturing Co. at Cleveland required ac voltages from 220 to 4800, dc voltages from 15 to 600, several frequencies and a variety of distribution systems. The job involved hinged wireways, interlocked armored cable, plug-in bus and underfloor ducts. Herbst Electric Co. handled the job. See "Multiple Systems serve Plant Power Needs" page 102.

# ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL
ASSORTMENT OF MATERIALS FOR A SELECTED JOB
AS OF NOVEMBER 1, 1951.
INDEX POINTS REPRESENT
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# **Washington Report**

The business outlook is for an immediate upturn, and for a continuing rise through 1957. This forecast is more than an election year boast, or device to get votes by the incumbent Republicans. It is based on sound economics, and current uptrends in major economic factors (page 91). Here's how Government seers look at it:

- Industrial output is on the rise, with steel mills back at work, and with new model autos going into production.
- Capital expenditures are rising, at a rate of about \$4 billion annually.
- New building construction continues its climb, at an overall annual rate of about 4%, bolstered by new gains in utility, private industrial, and highway construction.
- Output of services has shown gains all year, offsetting small decline in production, and primarily responsible for continued growth in gross national product.
- Personal incomes are rising at rate of \$10 billion or more annually, providing more money for consumer spending. (Personal savings are holding steady.)
- Strong competition will help stabilize cost of living, and with tighter credit will put curbs on inflation.

**Employment hit a record 66.7 million in mid-July,** up 152,000 from mid-June and up 1.6 million from mid-July of 1955, Depts. of Commerce and Labor reported. Unemployment was reported as 2.8 million, or 4% of the labor force, down from a month earlier, but up 362,000 over July 1955.

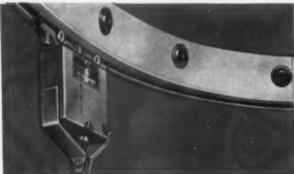
Electric power output hit a new high mark for summertime during first week of August, when the industry generated 11.53 billion kwhr. This was up 7.5% over a year earlier, in spite of mild weather and cut-back in industrial activity at that time due to steel strike. Output has been running an average of 12% ahead of year earlier figures this year.

Copper demand has increased slightly over low rate of July, but still lags behind production. Orders for September showed further gains. Outlook is for stronger demand as auto production picks up this fall.

Construction expenditures rose to a record \$4.2 billion in July, compared with \$4 billion in June and \$4.1 billion in July 1955, Commerce and Labor Depts. reported. Almost all types of construction (except housing) contributed to the 5% increase.

Housing construction has declined steadily for over a year, from an annual rate of about 1.4 million units to an unexpectedly low rate of about 1.1 million units since June. Decline in dollar volume has been less, however, as houses are getting larger and cost more per unit. Depts. of Commerce and Labor report "decline . . . is greater than anticipated because funds for long-term, low downpayment mortgages, at low interest rates, have remained relatively scarce."

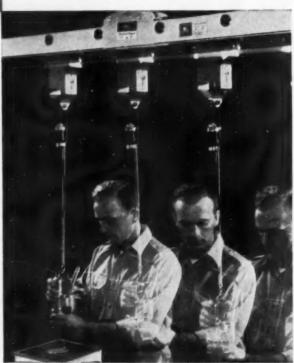
An omnibus housing bill was signed by President Eisenhower early in August which provides for 35,000 public housing units in each of the next two years. Also, Public Housing Administration contracted for 44,422 public housing units prior to July 31, 1956 under previous legislation, for more than 300 communities in 30 states. New York gets largest number, 7000; Chicago 3250; Philadelphia 1600; Washington, D. C. 1500.



SMOOTH-ROLLING TROLLEYS TAP POWER FROM DUCT, and can be added, removed or relocated in minutes without downtime or rewiring. Curved duct sections permit installation to fit any assembly line. Duct is rated at 100 to 225 amps to fit all mobile-tool needs.

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# THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

# What Caused It?

Why is the United States confronted with a serious shortage of scientists and engineers?

One reason, discussed in earlier editorials in this series, is that the increasingly complex technology needed for national security and for an expanding economy has raised enormously the demand for technically trained people.

But it is clear also that too little has been done to increase the supply of scientists and engineers and to make most effective use of the limited number now available. It is with this second reason for the shortage that this editorial deals.

Too few bright young people have been attracted to careers in the sciences and engineering. Many with technical training have been leaving these professions, with the exodus from teaching being especially alarming. And the technical talent now employed in industry, government and education is, in too many instances, being utilized less effectively than it might be.

# Paying for a Miscalculation

A legacy of the depression provides part of the explanation for the current shortage of young people entering scientific and engineering careers. Because of low birthrates in the 1930s, there are now about one million fewer boys and girls of college age than there were in the early 1940s. Not until 1960 will there be as many in the 18-21 age group as in 1945. And from the brightest young people of these ages must come, not only scientists and engineers, but the new members of all the professions needed by our growing economy.

A miscalculation in the late 1940s, when our future needs in various occupations were being gauged, provides another part of the explana-

tion. Occupational counselors and high school students were advised that, because of heavy postwar enrollments in engineering and other technical fields, "it is likely that the shortages of trained men will be alleviated in a few years."\*

Instead of being alleviated, however, the shortages became more acute. Job opportunities grew rapidly, while graduating classes dwindled. Fewer than half as many students received degrees in engineering in 1955 as in 1950, the peak postwar year. The trend has been reversed, but graduating classes will not be large enough to narrow the gap for several years.

### **Lost Talent**

Beyond these temporary conditions, there is another explanation for the failure of the number of scientists and engineers to keep pace with our rising needs. This is the staggering loss between high school and college of young people with the talent to be successful in science and engineering. Last year between 60,000 and 100,000 high school graduates of college ability failed to enroll in college for financial reasons and perhaps an additional 100,000 did not enter college because of lack of interest.†

Of the most intelligent 20 percent in the group of college age, fewer than half enter college and only about a third graduate from college. Educational authorities estimate that fewer than 2 percent of those in the college age group who are mentally equipped to obtain Ph. D. degrees will actually obtain such degrees.

Another crucial stage is in the high

<sup>&</sup>lt;sup>o</sup>U. S. Bureau of Labor Statistics, Occupational Outlook Handbook (Bulletin 940), p. 63.

<sup>†</sup>Charles C. Cole, Jr. (assistant dean, Columbia College, Columbia University), Higher Education, November 1955.

schools, where future scientists and engineers receive their first training in science and mathematics. There are serious weaknesses and signs of deterioration in this vital part of our educational system.

One-quarter of all American high schools offer no chemistry or physics. One-quarter offer no geometry. In many of the schools offering science and mathematics courses, the quality of instruction is low. Last year in the New York City school system alone more than 10,000 students were in science classes taught by teachers who were not trained in science.

'This is a situation that threatens to become much worse. Between 1950 and 1955 the number of graduating teachers qualified to teach high school mathematics dropped 53 percent and those qualified to teach science dropped 59 percent. Furthermore, only about 60 percent of the graduates certified to teach mathematics or science in 1955 entered teaching as a career.

On the students' side — partly because of inadequate guidance programs — there has been a drift away from science and mathematics courses. The result of low student interest, and poor high school programs, in science and mathematics is virtually to foreclose careers in science and engineering to many bright young people. They miss the necessary basic training. Many who do attempt to obtain college training in these fields are ill-equipped. Engineering school deans report that fully half of their students enter with deficiencies in mathematics.

# **Misuse of Trained People**

Scientific and engineering careers have long had a reputation for low salaries and limited opportunities for advancement. In recent years starting salaries have sky-rocketed and have been accorded wide publicity. But unfortunately there has been much less improvement in the salaries paid experienced engineers and scientists, especially in government and education. This has lowered the morale of experienced men and provided an incentive to desert engineering and research positions for higher paying jobs in sales or management.

respondent to the research scientists complain also that too much of their time now is spent on tasks that draftsmen and technicians could perform. Unfortunately for easy solution of this problem, however, there is an acute shortage of

technicians as well. Worse still, there are indications that some companies in industries using large numbers of engineers have gobbled up technical manpower at a faster rate than they can effectively employ these scarce people.

Another drain on the supply of newly-trained scientists and engineers is military service. About 8,000 of this year's 27,000 engineering graduates were in ROTC programs and committed to active duty after graduation. Dr. A. W. Davison, chairman of the Engineering Manpower Commission of the Engineers Joint Council, says that in most cases no attempt is made by the Armed Services to assign these young officers to duties for which their engineering education specifically prepared them. They are not only withheld from industry and education for two years but also are not utilized in defense programs requiring more engineers and research scientists.

Some of the causes for the present shortage of scientists and engineers—bad advice a few years ago and a college age group held down by depression birthrates in the 1930s—are gradually being overcome. But others, such as the deterioration of science and mathematics training in our public schools and the many instances of ineffective utilization of scarce technical talent, enjoy no such prospect of automatic correction. The final editorial in this series will deal with some practical suggestions for meeting these problems.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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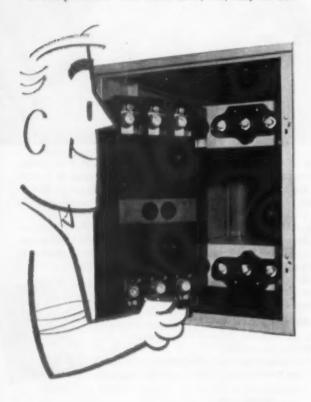
A complete line-four frame sizes, 100, 225, 400 and

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100 amp



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from 15 to 600 amp,
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Small Air Circuit Breaker Division





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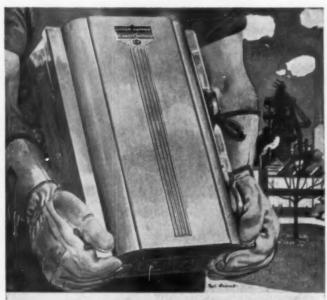
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Automatic pressure fuse receivers; no screws to forget to tighten... no screws to loosen in service by alternate expansion and contraction.

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Panel mounted mechanism of this new Bul. 4105 Safe(y Switch is readily interchangeable with that of the old Bul. 4101 to permit replacements without case and conduit work.

The new Cutler-Hammer Three-Star Motor Control has proved a sensation wherever it has been tested in comparison with any other control equipment. The tougher the tests, the more dramatic has been its demonstrated superiority. A kaolin processing plant in Georgia, for example, reports: "Because of the hard service we give motor control in our plant, we have always had to replace contacts every 30 to 60 days. Our first Three-Star Control unit has now been in daily use for thirteen months and its original contacts still look and work like new." A lumber mill in California says: "Control contacts have always been a problem on our drive of the feed chain going to the trim saw. We had to replace contacts every few weeks. Our first Three-Star Control on this job, purchased from the stock of our local Cutler-Hammer distributor, is now in its twenty-fourth month of continuous daily operation with its original contacts still in service."

Such control equipment brings important operating dependability and savings to any job where an electric motor is used. But it also means that such better motor control should be matched with a safety switch which can equal the performance of the motor control. And now this is possible. Cutler-Hammer Authorized Distributors are now stocked and ready to serve you with the new Bui. 4105 Safety Switch, the safety switch built to the standards of Cutler-Hammer Three-Star Motor Control. It is loaded with new features. See it.

Try it. Prove it. Order one today. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.



# Cutler-Hammer Three-Star Motor Control can now be obtained in every needed form



Cutler-Hammer Authorized Distributors carry stocks of Three-Star Motor Control in sizes and types of enclosures to meet all the usual industrial needs.



Leading machinery builders equip their machines with Cutter-Hammer Three-Star Motor Control as standard original equipment, often as components on panels.



The new Cutler-Hammer Three-Star Unitrol provides for the quickest installation or rearrangement of the finest in control equipment, C-H Three-Star Motor Control.

# "We had as many as 24 Solenoid coils a month burn up before we installed BUSS FUSTATS"...

"Now our burned up coil losses are negligible."

C. R. Babcock. CHIEF ELECTRICIAN DEWEY PORTLAND CEMENT CO. DAVENPORT, IOWA

### Mr. Babcock continues -

"The burning up of the solenoid coils that activate the plungers that dump our weighing scales was a real problem with us. We lost as many as 4 coils on one 8 hr. shift. The maximum was about 24 coils a month.

"Trouble develops on the days when the gypsum for our cement picks up moisture and sticks to the scales. Then the counterbalance can't reset the scale and, as a result, the plunger moves up and down energizing and de-energizing the thrust coil. The coil has only a few turns of large copper wire and draws a heavy current each time it is energized. It heats up quickly and burns up.

"To give over-load protection to the thrust coil, which is on a 125 volt DC power supply, we installed a 3.2 BUSS Fustat in a series with the coil. (BUSS Fustats are FUSETRON dual-element fuses with a type S base for use on circuits up to 125 volts.)

"Now, when there is trouble the Fustat opens before the coil is damaged. The scale is cleaned and another Fustat installed. We are then back in operation.

"We have three of these scales and at the present time we are replacing only about one coil a month and this is generally due to mechanical and moisture damage.

"We figure BUSS Fustats save us money in two ways — by practically eliminating the cost of replacing solenoid coils — and by greatly reducing our down-time losses."





On circuits of 125 volts or less -

### The Proper Size BUSS Fustat can Reduce Danger of Burnout of Solenoids, Coils, Transformers and Motors

A BUSS Fustat is a Fusetron dual-element fuse with a type S base for use on circuits of 125 volts or less. A Fustat gives all the protection of a fuse against short-circuits or dangerous overloads — yet, it permits circuit to be loaded safely to maximum capacity.

### Protecting Solenoids, Coils and Transformers —

By installing the proper size Fustat, a solenoid can be protected because the Fustat will not open on the operating surge but will open in time to protect, should the heavy current continue too long for any reason.

A transformer or coil, likewise, can be protected because the long time-lag of the Fustat permits it to hold all normal current surges and harmless overloads—yet it will open to prevent burnout on any dangerous overloads.

### Protecting Motors against burnouts —

A BUSS Fustat of motor-running protection size mounted anywhere in the circuit to handle ONLY the motor current will give finest available protection against burnout of the motor.

Nothing else is needed. Underwriters' Laboratories listing gives Fustats same degree of approval for both motor-running and short-circuit protection as the most expensive devices made.

# BUSS Fustats stop dangerous practice of tampering or overfuseing

The type S (tampering resisting) base of a Fustat prevents anyone replacing them with an ordinary fuse, a penny or other substitute — or with a size too large to protect.

Fustats fit ordinary Edison base fuse holders through use on an inexpensive adapter that once installed need never be replaced.

Write for bulletin SMPS.



### On any circuit up to 600 volts — Use a FUSETRON dual-element Fuse.

Fusetron fuses protect motors, solenoids, coils and transformers against burnout; they offer maximum safety because of their 100,000 amp. interrupting rating; they help increase production by eliminating needless blows and they cut maintenance costs because they are maintenance free.

Write for bulletin FIS . . .

For loads above 600 and up to 5,000 amps. — Use BUSS Hi-Cap Fuses.

When coordinated with Fusetron fuses they will not open ahead of the fuse negrest fault

Write for bulletin



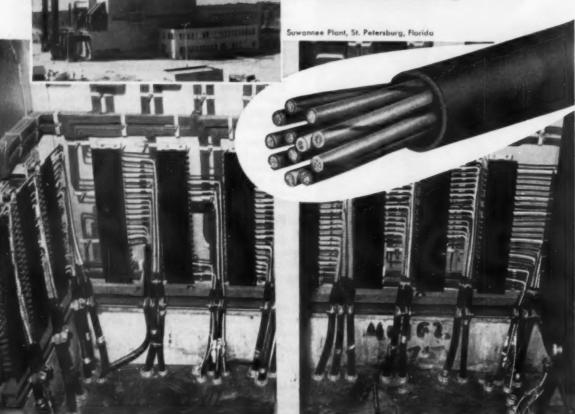
Play Safe! Install BUSS Fustats, FUSETRON Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!

Bussmann Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.



### FLORIDA POWER CORPORATION

# **EXPANDS CAPACITY**



Turbine board, Higgins Plant, Unit #2

# USES ROCKBESTOS PNR

SMALL DIAMETER CONTROL CABLE

Since 1946 Florida Power Corporation has been expanding its generating capacity so that at the end of 1955 it had a net generating capacity of 507,628 kw.

To insure safe dependable operation of its control circuit
Florida Power Corporation installed 207,600 ft. of
No. 9AWG Rockbestos PNR Small Diameter Control Cable.

You, too, can benefit with Rackbestos PNR. This outstanding control cable lets you pull 12 conductors in conduit where before you had only seven. You save conduit and fittings . . . cut installation costs. Get the full story today. Write or call your nearest Rockbestos Field Engineer.

\*Average determined by comparison with conventional control cable.

### PROPERTIES OF PHR

46% smaller in area\*...28% smaller in diameter\* than conventional control cable.
Use smaller conduit and fittings or put more conductors in existing conduit.

Lighter, easier to handle, store, ship, pull through conduit.

Dielectric breakdown . . . over 40 times operating voltage.

Rated 600 volts . . . conductor operating temperature 167°F.

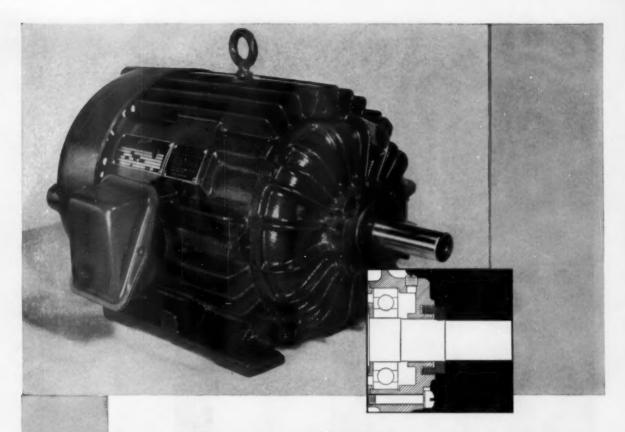
Flexible from 167° to -67°F.
No cracking!

ROCKBESTOS PRODUCTS NEW HAVEN 4, CONN.



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# Securely sealed for low maintenance -

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# TOTALLY ENCLOSED FAN COOLED MOTORS

When motor maintenance goes down, production goes up. Century TEFC Motor protects itself from dust, grit, chemical fumes, moisture. Shaft openings at each end are labyrinth-sealed, and there is a precision clearance between metal seal and bearing bracket.

Outside, a hose or whisk broom quickly cleans it. External fan forces jets of cooling air across the frame. Inside, vital motor parts are completely sealed off from injurious atmosphere. Factory lubrication of bearings is adequate for several years' service under normal conditions; however, whenever required bearings may be relubricated through grease plugs.

For full facts on your specific application, call the Century District Office or Authorized Distributor nearest you.

CENTURY... building TEFC Motors for 25 years

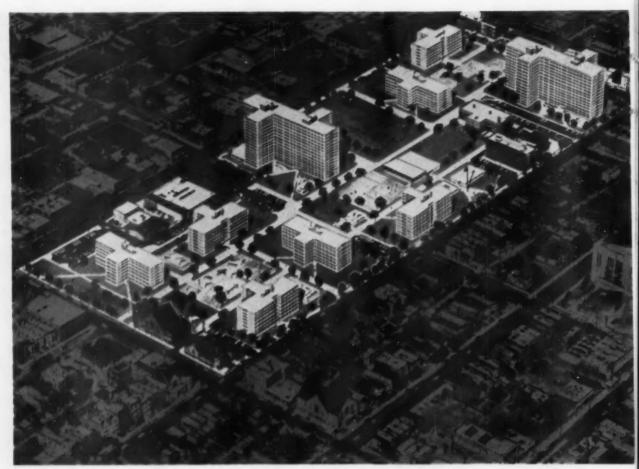
CE-66R

Performance-Rated
MOTORS
1/20 to 400 H.P.



# CENTURY ELECTRIC COMPANY

1806 Pine Street . St. Louis 3, Missouri . Offices and Stock Points in Principal Cities



Governor Henry Horner Homes, Chicago Housing Authority, Chicago, Ill. Architects-Engineers: Skidmore, Owings & Merrill, Chicago. General Contractors: Sumner Sollitt Company, Chicago. Electrical Contractors: Emerson Comstock Co., Inc., Chicago. Electrical Distributor: Graybar Electric Co. Inc., Chicago.



cutting electrunite is easy with ordinary 32tooth hacksaw blade. "Inch-Marked" in the popular sizes—an exclusive with Republic you simply measure the distance, not the tubing. There's no messy threading either. ELECTRUNITE's joined by ordinary couplings.

BENDING BLECTRUNITE to the correct radius is simplified using "Inch-Marks". "Guide Line" eliminates "wows". All reference marks for heights of bend and position of bender on tube are cast in the rugged one-piece Republic Calibrated Bender.



# REPUBLIC



World's Widest Range of Standard Steels

# 250,000 FEET

# of Republic "Inch-Marked" E.M.T. protects big Chicago low-rent housing project

That's a lot of protection—and worth every foot of it. Whether the job is small—or big like the magnificent Henry Horner Housing Project pictured at the left, electrical contractors find that Republic ELECTRUNITE E. M.T.<sup>®</sup> is easier and more economical to install.

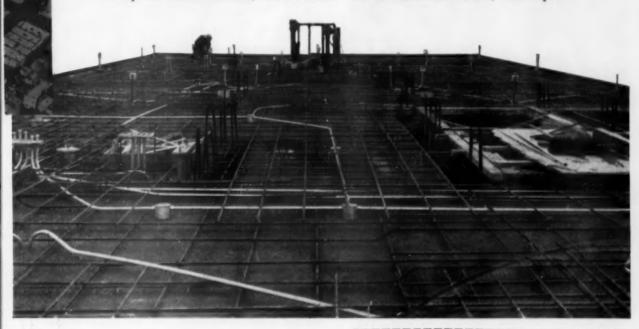
This tremendous job provided electricians plenty of opportunity to take advantage of Republic ELECTRUNITE's money-saving features. Erected by the Chicago Housing Authority, the eight smartly styled apartment buildings included nearly 50 miles of electrical conduit with more bends than you'd care to count.

And yet with ELECTRUNITE's exclusive "Guide Line" that eliminates "wows"—plus the Republic Bender—smooth, accurate bends

were easy to make every time. Another exclusive feature, "Inch-Marking", enabled electricians to cut the tubing at these marks without measuring. Additional time was saved by the "inside knurling" feature which makes wire-pulling as much as 30% easier.

Everyone likes Republic ELECTRUNITE E.M.T. because it makes work easier. There are fewer tools to carry around. No threads to cut. No lines to turn. Lengths are joined by couplings. To make tight joints, just tighten the fitting, not the entire run.

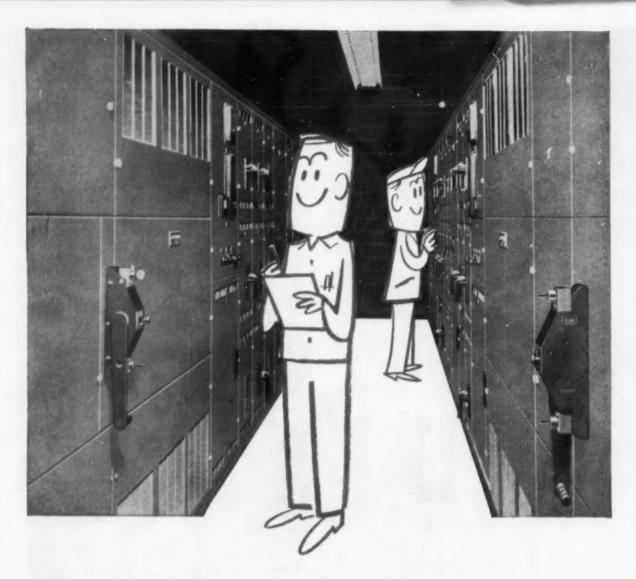
So, for a saving on your next job, whatever the size, specify Republic ELECTRUNITE E.M.T. and get the best run for your money. For additional information, mail coupon.



# STEEL

and Steel Products

# 



# Bring dependable electric power nearer to where you use it —install an I-T-E Secondary Unit Substation in your plant

I-T-E Secondary Unit Substations make electric power more dependable, more economical. They bring higher voltages nearer the load, reduce power losses. They increase machine efficiency, reduce voltage drops inherent in long low-voltage runs. They save space—all necessary components are housed in one functionally designed unit. They protect plant personnel—all live parts are isolated and metal enclosed.

In addition, you save in delivery and installation time. All I-T-E Secondary Unit Substations are assembled, tested and shipped ready to install from one source of supply. And they are available for any application, indoor or outdoor, in any standard rating.

For complete information, contact your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.



I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

Don't let Poison IVY
short-circuit his
WORK
HOURS

# ZIRNOX

can be relied on for effective

PREVENTION: Effectively wards off poison ivy, poison oak, poison sumac

- if applied before exposure
- or within eight hours after exposure

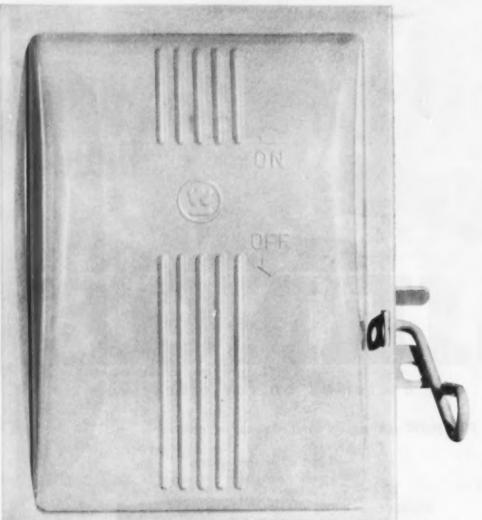
**RELIEF:** Eases itching and retards spread

- If applied in early stages



Contains hydrous zirconium oxide 4%, Bristamin dihydrogen citrate 1%, in a non-greasy lotion base.

# SAVES UP TO 35% MORE SPACE



MORE SPACE

NEW FROM WESTINGHOUSE... and available immediately! The Type G safety switch with a new smaller design gives you space savings up to 35% where space counts!

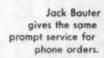
And economy of space isn't the only advantage. Packed into this functional unit are the kind of features that add up to economical and lasting fused circuit protection. (More information on request.)

Available in four ratings: 30, 60, 100, and 200 amps . . . 2, 3, and 4 pole, 240 volts, fused or unfused.

Your Westinghouse distributor can give you stock delivery. See him today.

# **WATCH WESTINGHOUSE!**

DOVER THE PRESIDENTIAL CAMPAGE ON CHE FELEVISION AND RADIO!

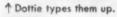




Personal attention from George Watts starts your mail orders right.



**↓** Eddie ships themand out they go-pronto!





← Joe Kernell approves your credit.





Ray Stradal purchases material to fill your orders.



↑ Charlie Cintalon expedites them.

Cliff Winkler

schedules the orders.

Charlie Champlin engineers the ceiling layout designs.

> From sale to shipment-your orders receive fast, efficient handling by your friends at Guth. They

take pride in "delivering the goods".

It's a matter of team work. There's no time-wasting red tape, no unnecessary delays. All orders are processed in one smooth, continuous operation that spells unsurpassed service in the industry; a tradition that has been established by Guth since 1902.

TRUSTED NAME IN

THE EDWIN F. GUTH COMPANY . ST. LOUIS 3, MO.

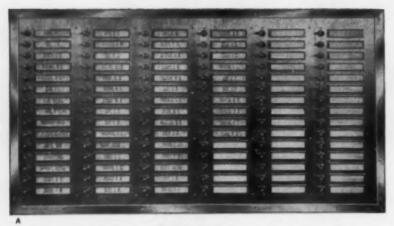
LIGHTING SINCE 1902 ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1956

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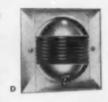
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Also available . . . Fire Alarm
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High-calibre Electrical, Electronic, or Audio Distributor Representatives are needed... on an exclusive territory basis... to represent and promote Cannon Specialty Products to architects, hospital and other public building administrators, restaurants, hotels, motels, professional offices, manufacturing and service organization offices, electrical distributors, electrical contractors and other users.

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Refer to Dept. 429

CANNON SPECIALTY PRODUCTS ARE MADE BY THE WORLD RENOWNED MANUFACTURERS OF MULTI-CONTACT ELECTRIC CONNECTORS



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ROEBLING POWER CABLES WITH THE

# 3-WAY PAYOFF

ROEBLING Roeprene Type USE, Style RR Cables were specially designed for direct burial. Non-metallic (Neoprene) sheathed, with either RHW, or RH-RW insulation they are approved by Underwriters' Laboratories as Type USE and conform to National Electrical Code requirements.

These power cables are really versatile...remarkably adapted for general use. They meet IPCEA specifications for use in ducts and conduits... and for aerial use.

Roebling Roeprene Type USE, Style RR Cables are available in single and multiple conductor construction, sizes 12 to 4/0. Size 14 AWG may be obtained for special applications. Write for full data on these low-cost power cables, and order them from your distributor.

ROEBLING ELECTRICAL WIRES AND CABLES ARE AVAILABLE WITH EITHER COPPER OR ALUMINUM CONDUCTORS

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Subsidiary of The Colorado Fuel and Iron Corporation

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# INDUSTRIAL INCANDESCENTS

# DETACHABLE

Mounting and socket assembly easily attached and wired as a complete unit. Reflector attaches without tools or handling of loose parts.

# SIMPLE TO INSTALL

Detachable: The small lightweight mounting and socket assembly, oversize wireways and large exposed terminal screws are designed for maximum economy of installation. Reflectors are easily detachable without use of tools for floor-level cleaning.

# TOP QUALITY

Detachable: Die-cast housing and clamping ring with gripping fins for easy hand tightening. Reflector is supported by the mounting assembly with no strain on the socket.

# MILLER PATENTED

For both Detachable

- Center contact spring-loaded for continuing positive connection (spring does not carry any current).
- Mogul sockets are ventilated to prevent lamp from "freezing" in the socket.

# REFLECTOR

For both Detachable

- Louvred Ventilation: to protect the lamp from dripping moisture.
- White Porcelain Enamel Finish: White\* to comply with current trend to a lighter environment. Porcelain enamel insures long life, easy cleaning.

\*Green on special order when required or to match existing installations.

YOUR MILLER DISTRIBUTOR OR MILLER REPRESENTATIVE WILL GLADLY CALL AND DEMONSTRATE THESE AND MANY OTHER FEATURES — OR WRITE FOR CATALOG IN-5

# BY miller : LOUVERED FOR VENTILATION : ALL-WHITE REFLECTORS : TWO MOUNTING TYPES

DISCONNECT

Mounting and socket contact

assembly easily connects or dis-

connect via 3 bayonet slots

engaging heavy-duty lugs

in mounting assembly.

# EASY TO MAINTAIN

Disconnect: For owners and contractors alike, the rugged yet simple construction means lower installation costs and convenience of maintenance. Oversize wireways, jumbo terminal screws, open-faced terminal blocks and positive locking action are features of Miller's new disconnect design.

# CONSTRUCTION

Disconnect: Porcelain contact block snaps out for easy wiring. Recessed circular contacts maintain polarity. Barrier type design guards against shorting when reinstalling reflector. Three heavy-duty stainless steel lugs engage heavy steel bayonet ring for positive connection.

# SOCKET

### and Disconnect

- UL, AFL-IBEW labels.
- Precision balanced shock absorber springs optional to prolong lamp life in vibration conditions.
- Available in pendant, outlet box and side entry types.

# FEATURES

### and Disconnect

Interchangeable: Disconnect reflectors completely interchangeable by wattage and reflector types. Detachable medium-base reflectors and mogul-base reflectors can be interchanged.

■ Variety of Types: RLM Standard Dome • Shallow Dome • Standard Angle • Elliptical Angle • Silver Bowl Dome • RLM Glassteel • Porcelain High Bay . Aluminum High Bay

Better Lighting for a Brighter America

THE MILLER COMPANY . GENERAL OFFICES: MERIDEN, CONN. . FACTORIES: UTICA, OHIO-MERIDEN, CONN. . IN CANADA: CURTIS LIGHTING OF CANADA LTD., TORONTO

# ONLY HEINEMANN CIRCUIT BREAKERS

give you all THREE

## A DEFINITE RATING . . .

unaffected by temperature. A 20 ampere rating means 20 amperes of safe, usable capacity. There is no de-rating of Heinemann Circuit Breakers.





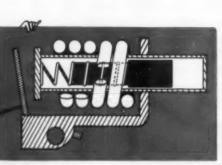
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# INVERSE TIME DELAY...

prevents nuisance power interruptions... permits starting inrush and harmless, temporary overloads. Gives maximum protection without inconvenience.







# INFORMATIVE BOOKLET: "What You Should Know About Circuit Breakers"... Send for your free copy.

# SELF-ADJUSTING TIME ELEMENT...

varies time delay, not the rating or instantaneous trip point, to allow more time to make cold starts or to shorten delay under dangerous heat conditions.

HEINEMANN

Circuit breakers

HEINEMANN ELECTRIC COMPANY 132 PLUM STREET TRENTON 2, N. J.



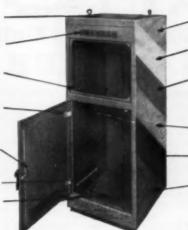
WHEN HIGH VOLTAGE switchgear gets rusty, power must be cut off for repairs and repainting. That means service work must be done on overtime, when the plant is not operating.

S&C believes that metalclad switchgear should be out of sight and out of mind—except on those rare

occasions when it operates as a protective device, or when switching is necessary. The extent to which S&C goes to prevent rust and avoid switchgear maintenance is illustrated below. Only a detail? Perhaps . . . but a mighty BIG detail when less careful engineering can cause avoidable service work.

# Here Is WHY S&C Metalclad Switchgear Resists Rust and Reduces Maintenance Costs

- Inside of top is coated with Insulmat ® to prevent condensation.
- Louvers are placed to provide free air circulation.
- Before welding, lapped and butted surfaces are zinc coated, eliminating bare surfaces which might rust.
- Hinges and edges, as well as bolt and latch holes, are zinc coated to assure protection of hidden surfaces.
- Hinge pins are stainless steel.
   Hinges, door locks, and other ferrous working parts are galvanized.
- Strip heaters prevent condensation.
- Underneath, surfaces are coated with water-repellent Texacote® to provide protection against ground moisture.



- Cold-rolled steel makes a scale-free, oxide-free base.
- All welds and sharp edges are ground smooth.
- Surfaces are thoroughly phosphatized to remove grease and provide a neutral, rust-resistant surface that assures good bonding.
- Zinc coating prevents rust from spreading in case surface is scratched.
- To make a good bond, zinc chromate is used for the prime coat.
- Finish coat is a new melaminealkyd-urea synthetic applied by the hot-spray method and oven-baked at 375°. It has a thickness equal to four coats of conventional enamel or lacquer.



Specialists in High-Voltage Switchgear for Electric Utilities since 1910

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# Today's RLM "Specs" for **Industrial Lighting Units are**

Back in 1919, when the first RLM Dome Reflector Specification was established, if someone had suggested that someday industry would require a lighting unit which directed 20%-30% of its light toward the ceiling-there would have been quite a few raised eyebrows. Yet, today 20%-30% Upward Light is an

accepted factor contributing to better seeing in modern factories . . . while the basic RLM Dome is still indispensable in many industrial applications.

Through the years, RLM Standards for quality in lighting equipment performance and construction are keeping pace with industrial lighting progress. Today, both the first and latest types of

units are covered by HIGHER THAN EVER RLM SPECIFICATIONS ... and so are 34 other incandescent and fluorescent units for which RLM Standards have been established.

It is especially important for you who buy, use, specify or sell industrial lighting equipment, to take advantage of these

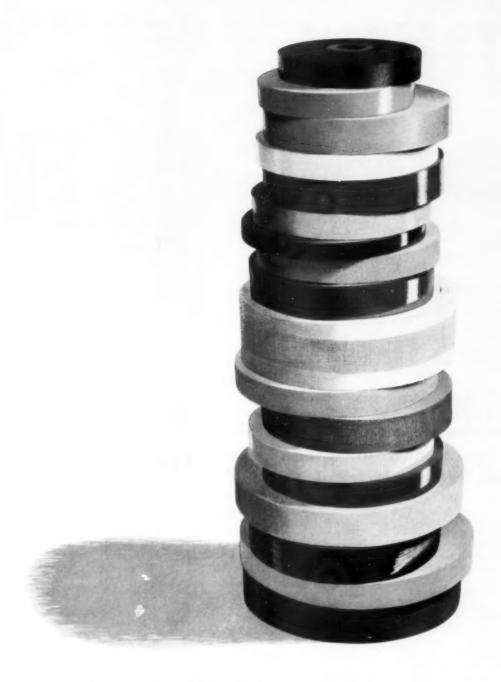
higher-than-ever specs. More than ever before, they contribute to uniformly satisfactory industrial lighting equipment performance. The 1956 Edition RLM Book brings you all the newlyestablished and revised RLM Specifications. Get your free copy from: RLM Standards Institute, Suite 819, 326 W. Madison Street, Chicago 6, Illinois.

### Typical HIGHER-THAN-EVER RLM SPECIFICATIONS

for incandescent and fluorescent units:

- New High Reflection Factor ●New High Light Output
  - for fluorescent units:
  - All-White Porcelain Enamel Reflectors
     Upward Light for more Brightness Control
     New Shielding Angles for less Lamp Glare





whatever the job ...

# PERMACEL TAPES

In our complete line, there's a self-sticking tape for every job ... write Permacel Tape Corporation, New Brunswick, N. J.

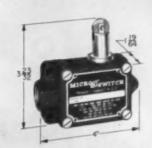
a Johnson Johnson company

# MICRO precisi

THEIR USE IS PRINCIPLE OF GOOD DESIGN



Button-type lever actuator



Sealed roller plunger actuator



Sealed plunger



Sealed roller lever

# **High-Capacity enclosed switches** for plant applications with heavy electrical loads

Many plant applications call for installation of switches which have more than average electrical capacity. міско switch high-capacity enclosed switches meet this requirement with the capacity to make and break steady state currents of 20 amperes, 125, 250, or 460 volts a-c. They will handle inrush currents as high as 75 amperes - switch 10 amperes 125 volts when controlling tungsten filament lamp loads on a-c circuits.

All the types shown are available for either right- or left-hand mounting. They are widely used on present plant equipment as safeties, limits, and interlocks.

Button-type lever actuator: This actuator can be adjusted horizontally through 360° and vertically through 225°. The actuator is sealed with an elastomer (neoprene) boot. The switch is for manual operation.

Sealed plunger actuator: An elastomer boot covers the operating plunger and a ring gasket seals the cover. Die-cast aluminum enclosure protects the basic switch from vibration and shock.

Sealed roller plunger actuator: For cam or slide operation in applications where the approach of the actuating device is not parallel to the switch. Roller plunger assembly adjustable through 360°. Scals prevent entrance of dust, dirt, or moisture.

Sealed roller lever actuator: Well adapted to operation by any type of operation-straight line or cam. Roller lever can be locked in any position at intervals of .2 degrees within a range of 225°. Entire roller bracket can be rotated horizontally through 360° and tightened down in any position.

These switches are typical of a wide variety of MICRO precision switches which have proved successful in making existing machinery safer, more automatic, and more productive.

**Basic Switch** is Replaceable



The basic switch can be easily replaced, if necessary, without removing the enclosure from its mounting. Ample wiring space within the enclosure and the side facing terminals of the basic switch simplify wiring.

# Underwriters' **Laboratories Listing**

1 H.P. 115 volts a-c 2 H.P. 230 volts a-c 20 amperes 125, 250, or 460 volts a-c 1/2 ampere 125 volts d-c

1/4 ampere 250 volts d-c

Send for Catalog 101 "Switches Industry"

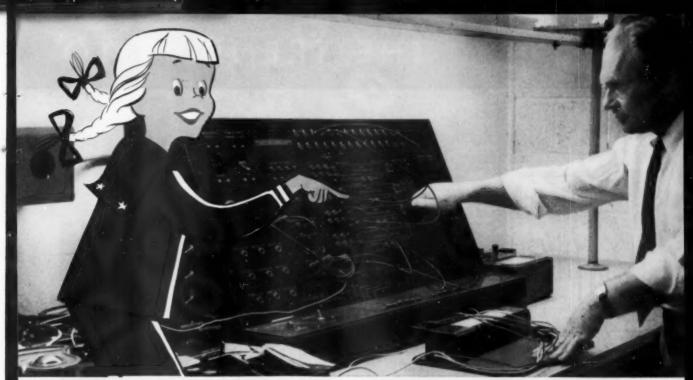


MICRO precision switches are carried in stock by distributors in every key city. Look under "Switches, Electric" in the Yellow Pages.

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario . FREEPORT, ILLINOIS





EXCLUSIVE ELECTRICAL TESTS provide 100% check of G-E bullasts assuring you of rated output from ballast to lamp. When you buy or specify General Electric ballasts, you're assured of up to 30 % more light and up to 50 % longer lamp life. This helps you save lighting dollars.

Flora\* shows you why . . .

### **G-E Lamp-matched Ballasts Give You** Up to 50% More Lamp Life, 30% More Light

The life and light output ratings of fluorescent lamps are based on their use with ballasts which provide the required operating characteristics. General Electric lamp-matched ballasts meet all lamp requirements; in many ways they exceed prescribed lamp and CBM specifications.

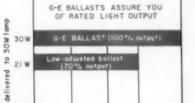
An indication of the importance of the ballast to more economical lighting is given in a report issued by the General Electric Lamp Division which reads in part: "Tests indicate that ballasts which deliver improper values reduce lamp life by as much as 50% and light output by as much as 30%."

To fluorescent lighting users, this means G-E ballasts can save thousands of dollars in lighting costs.

Next time you specify equipment for a fluorescent lighting installation, make

sure you get the best . . . specify General Electric lamp-matched ballasts.

A G-E ballast tag or sticker on your fixture is proof that it's equipped with the best in ballasts. It's the easy way to be certain. For further information on G-E ballasts, write Section 401-14, General Electric Company, Schenectady 5, New York.



Percent of rated light output RESULTS OF A SPECIFIC TEST show that light eutput can be reduced by as much as 30% when ballasts de not deliver specified electrical values. Specify G.E. for rated output.

#### Five more reasons why

#### GENERAL ELECTRIC IS YOUR BEST BALLAST VALUE

- EXCLUSIVE SOUND RATING SYSTEM
- SUPERIOR QUALITY CONTROL
- LONGER BALLAST LIFE
- PROVED PRODUCT LEADERSHIP
- COMPLETE CUSTOMER SERVICES



Progress Is Our Most Important Product

GENERAL \Re ELECTRIC

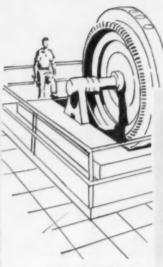


### THE TREND IS TO



DC POWER FOR **ELEVATORS** 



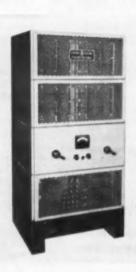


DC POWER FOR SYNCHRONOUS MOTOR EXCITATION





DC POWER FOR GENERAL SHOP USE



DC POWER FOR MAGNETIC DEVICES



#### WHERE GENERAL ELECTRIC SELENIUM RECTIFIERS

ELEVATOR POWER SUPPLY

Commercial Buildings Foundries Crans and Hout Maters

Railroad Shops Warehouses

SYNCHRONOUS MOTOR EXCITATION

### METALLIC RECTIFIERS

When you need direct current—

### **General Electric Selenium Rectifiers** Cost Less to Install, Operate, Maintain

Full line of units from 3/4 to 125 kw-with multiples for higher ratings

"The trend to metallic rectifiers" is based on economy.

Compared to other types of power-conversion equipment, General Electric selenium rectifiers: cost less to install (light weight, no heavy rotating parts, no need for special foundation); cost less to operate (over 80 per cent efficient from light load to full load); cost less to maintain (a small fan motor is the only moving part). They also save valuable floor space by providing, in one compact package, a complete power-conversion means—with no need for external accessories.

Whether you're considering a modernization program or simply need more spot d-c power, it will pay you to consider General Electric selenium rectifiers. Whatever your direct-current application-general shop power, elevator power supply, synchronous motor excitation, magnetic devices, etc.—there is a General Electric metallic rectifier designed and rated to do the job efficiently. General Electric offers a full line of selenium units from 3/4 kw to 125 kw (15 ratings in all), which may be paralleled for higher ratings. And for other specialized applications, General Electric offers the latest in germanium and silicon rectifiers.

If you would like to know more about how General Electric selenium rectifiers can supply dependable,

low-cost power for your direct-current operations, contact your nearest General Electric Apparatus Sales Office or write for bulletin GEA-6545 to Section 462-13, General Electric Company, Schenectady, N.Y.



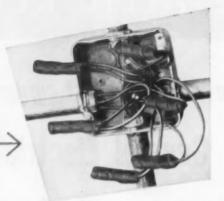
Typical use of G-E selenium rectifiers is this 800-amp, 125-volt installation which supplies d-c power for elevators, fans, and airconditioning units in a large building. The rectifiers replaced three turbine-generator sets, saving space and reducing maintenance.

Progress Is Our Most Important Product

GENERAL & ELECTRIC

ARE SAVING MONEY IN INDUSTRY TODAY

#### **Avoid this**

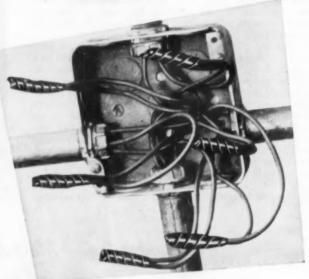


#### use this



## for results like this...

For neat, sure insulation without bulk, use Porter vinyl electrical tape. One operation does the job. No outer wrapping needed. Dielectric strength stands up to high voltages. Resistant to acids, water, corrosion. Conforms readily to curves. Retains adhesion under toughest service conditions. Ideal for production line and maintenance work. Order from your Quaker distributor.





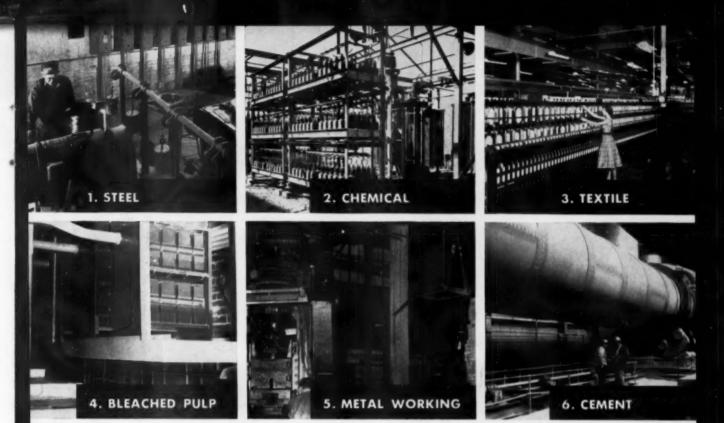
Porter Vinyl Electrical Tape carries Underwriters' Laboratories Inc. seal



QUAKER RUBBER DIVISION

H. K. PORTER COMPANY, INC.

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1956



## HERE'S HOW GENERAL ELECTRIC CAPACITORS ARE PAYING DIVIDENDS FOR SIX INDUSTRIALS

Here are the stories of six manufacturers who are now realizing high return on investment in terms of dollar savings, increased circuit capacity and better plant operating conditions by installing G-E industrial capacitors.

- 1. Atlantic Steel Company, Atlanta, Georgia, converted from line shaft drives to individual motor drives on its nail-making machines. Installation of 45 G-E 4-kvar capacitors at the motors helped make changeover possible by removing power factor problems arising from high motor starting torque.
- 2. Shea Chemical Corporation, Columbia, Tennessee, purchases its power on the basis of kilowatt demand with a sliding price scale for amounts over 29,000 kw. Installation of G-E capacitors helped raise power factor to 93.4%—saving Shea approximately \$1250 a month in electric utility demand charges.
- **3.** Pepperell Manufacturing Company, Lindale, Georgia, now saves an estimated \$15,000 a year in power costs. General Electric capacitors helped raise Pepperell's plant power factor from 75% to better than 97%, enabling its utility to grant a lower rate.
- **4.** Riegel Paper Corporation, Carolina Division, Acme, North Carolina, released an additional 1875 kw capacity by raising plant power factor from 82% to 95% with G-E

industrial capacitors. Other benefits for Riegel were relief of overloaded load centers and postponement of the need to buy additional distribution and generating equipment.

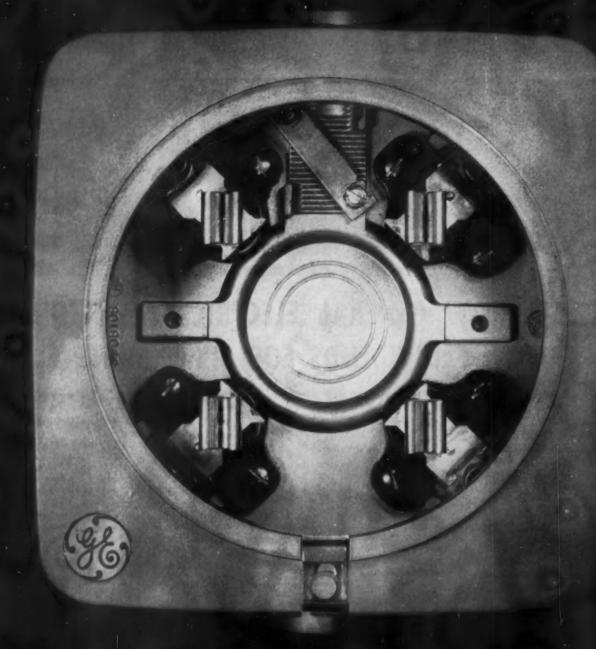
- **5.** Empire Plow Company, Cleveland, Ohio, paid off its capacitor investment of \$1907 in just eight months, out of power bill savings. After 240 kvar of capacitors were installed, power factor rose to better than 97%. Improvement in power factor meant real savings in power bills.
- 6. Peerless Cement Company, Detroit, Michigan, needed additional power from its generating equipment because expanded facilities called for increased motor load throughout the plant. Installation of G-E capacitors raised power factor from 92% to 96%, allowing present generating facilities to handle the growing motor load and increasing the carrying capacity of previously overloaded feeders.

No matter where you are, no matter what you manufacture, General Electric capacitors may be able to give you dollar savings, increased system capacity, or improved operating conditions. Ask your G-E sales engineer how capacitors can be of specific benefit in your plant. For more information, write for bulletin GED-2978, "The Capacitor Digest," Section 441-114, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product



## NEW G-E Square Meter Socket



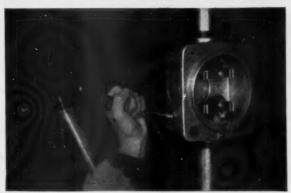
Progress Is Our Most Important Product

GENERAL (%) ELECTRIC



## for Installations Up to 100 Amps

offers you these important, money-saving benefits



1. POSITIVE, ONE-WAY KNOCKOUTS—New pre-scoring arrangement on both inside and outside of socket assures perfect knockout every time. No prying or bending needed.



2. EASIER ACCESS—Unique snap-lock cover can be removed and replaced in seconds without any tools. Just flick the lock, lift the cover and socket is open and ready for wiring.



3. 100-AMP CAPACITY—Assures that today's installation will meet greater loads of future. New socket is perfect partner for General Electric's I-55 extended range meters.



 EASIER, FASTER WIRING—a unique, modern design, plus lay-in type terminals requiring wiring bend of only 45 degrees speeds up and simplifies installation.



GREATER VERSATILITY—New G-E square meter socket can be mounted vertically or horizontally. Added flexibility is obtained by easy addition of fifth or sixth terminal.



 A COMPLETE LINE—CT sockets, high-capacity, box-type, and round and square sockets for single-phase meters.





The Fax brothers, Robert (left) and Richard (center) talk with Richard A. Welter of the Bell Telephone Company of Pennsylvania, in front of the model home on the tract of Plymouth Meeting Park, their very successful new home project.

### "Concealed telephone wiring is essential in livable homes"

-say Robert and Richard Fox of Fox-Bilt Homes, Inc., Plymouth Meeting Park, Pa.

"We build homes designed for maximum livability," says Robert Fox. "Concealed telephone wiring is a very important feature of that livability. Customers like the convenience of planned outlets in their homes."

"Also," adds brother Richard Fox, "concealed telephone wiring keeps the beauty of the rooms intact. Customers like that, too. Concealed wiring, telephone as well as electrical, helps us build homes we're proud to offer, and that customers are proud to live in and show to their friends."

Robert and Richard Fox have built many homes in the suburbs of Philadelphia. And their houses sell rapidly in Philadelphia's competitive market. They feature proven products that customers can rely on. Among those products is concealed telephone wiring, which the Fox brothers, along with trend-minded builders across the country, consider a necessary sales feature.

Your nearest Bell Telephone business office will help with concealed wiring plans. Just ask for "Architects and Builders Service." For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM





of top-quality Circle wire and cable roll out of these huge plants every year!

It takes the combined facilities of two of the country's largest building wire and cable plants to turn out this footage every year - enough, incidentally, to circle the earth eight times!

It takes a small army of experienced engineers, operators, and technicians . . . thousands of tons of copper, steel, zinc, lead, rubber and other protective materials . . . and batteries of modern, high-speed machines to process it all.

It takes a highly organized system of quality control with extensive laboratory and testing facilities to insure

that every foot of Circle wire and cable is as perfect as it can be.

And to distribute this tremendous footage to the electrical industry, it takes a nationwide chain of well-stocked warehouses geared to give fast, dependable, friendly service through Circle distributors.

All of which is good reason why you can always rely on Circle and your Circle distributor for all your building wire and cable needs. Circle Wire & Cable Corp., 5500 Maspeth Ave., Maspeth, Long Island, N. Y.

Circle's modern copper rod and steel flattening unit at Hicksville, Long Island, can roll 150 million lbs, of copper alone per year. It also supplies copper rod to other users in the field.



Perhaps the biggest reason why Circle has grown to be one of the country's largest producers of building wire and cable is its record for fast, friendly service. A nationwide network of 22 warehouses supports this policy.



CIRCLE

WIRE & CABLE

a subsidiary of Cerro de Pasco Corporation

PLANTS: Maspeth and Hicksville, N.Y. SALES OFFICES & WAREHOUSES: Atlanto, Baltimore, Boston, Chicago, Cincinnati, Dallas, Des Maines, Detroit, Houston, Jacksonville, Los Angeles, Miami, Minneapolis, Nashville, New Orleans, Omaha, Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Seattle, St. Louis. ADDITIONAL SALES OFFICES: Cleveland, Davenport, Ia., Newark, New Haven, New York, Utica.

RUBBER COVERED WIRES & CABLES - VARNISHED CAMBRIC CABLES - PLASTIC INSULATED CABLES - NEOPRENE SHEATHED CABLES



#### Lighting by DAY-BRITE makes the big difference . . .



Mr. William Weisfeld of Weisfeld & Son, New Orleans, La.

#### "We get a fine job with Day-Brite fixtures"

"Day-Brite fixtures give us everything we need to complete a fine job that pleases the owner and helps us sell the next job.

"We don't have to do a lot of explaining about quality. It's so evident in Day-Brite fixtures that everyone can see it right away.

"Our men on the job especially appreciate those qualities that make a Day-Brite installation easy. Everything is furnishedwe can go through a job from start to finish without wasted time or motion.

"All this, and more, adds up to a fine jobone that both we and the owners are proud of."

In making these comments about Day-Brite fixtures, Mr. Weisfeld speaks from experience-his own and that of hundreds of contractors throughout the country.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



One of Weisfeld & Son's recent jobsthe Crippled Children's Hospital, New Orleans, La.

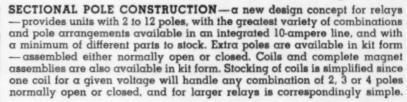


Day-Brite Lighting, Inc. 5402 Bulwer Avenue St. Louis 7, Missouri

## From 5 basic models you get 10 standard relays with the new CLARK Type "PM" Relay line

#### The 5 Basic Models

No. 5U-4 Basic 4-Pole





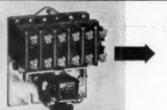




By removing one or two poles, the standard 4-pole unit becomes a 2 or 3-pole relay.

2-POLE 3-POLE 4-POLE

No. 5U-6 Basic 6-Pole







8-POLE

By adding 2 poles next to magnet, the standard 6-pole relay becomes an 8-pole unit —the first 8-pole relay available for single deck wiring.

No. 5UK-8 Basic 8-Pole





6-POLE



By removing 2 poles from the double-decked 8-pole relay, you get an alternate 8-pole of double-deck construction.

Double - decked

E 8-POLE cked Double-decked

No. 5U-12 Basic 12-Pole





10-POLE



With 2 poles removed, the 12pole unit becomes the standard 10-pole relay. Both have identical mounting dimensions with NEMA standard size 1 starters.

No. 5UK-2 2-Pole



2-POLE "SPACE SAVER"—a special purpose relay designed exclusively to meet small or unusual space requirements. Overall height less than 3 inches,

Write for  $\theta$ -page illustrated Bulletin PL-7305 for complete information on this revolutionary new line of heavy-duty relays.

The CLARK

Engineered Electrical Control



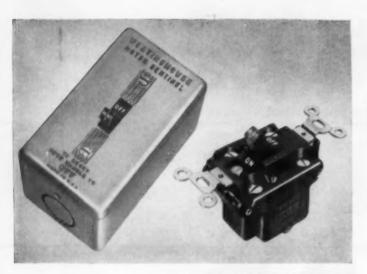
CONTROLLER Company

1146 East 152nd Street

Cleveland 10, Ohio

### Westinghouse manual controls...

## today's greatest value for more positive small-motor protection!



Motor Sentinel in NEMA 1 enclosure.

#### For ratings up to 1 hp

The Westinghouse Motor Sentinel\* offers the most positive and permanent motor protection you can buy. Bimetallic overload protection, straight-through wiring, and many other outstanding extras add up to longer life, easier installation—greater savings for you in every way.

Available in single or double pole, for single-phase motor applications, in three NEMA enclosures—general-purpose, waterand dust-tight, and explosion-proof.

\*Trade-Mark



De-ion® Motor Watchman in NEMA 12 enclosure:

#### Up to 71/2 hp a-c or 2 hp d-c

Snap-action, bimetallic disc—a Westinghouse exclusive—provides absolute motor protection. And you can rely on the Westinghouse Motor Watchman® indefinitely because, even after years of operation, the bimetallic disc retains its precise calibration—never needs adjustment.

Comes in new NEMA 12 enclosure and a wide range of other NEMA enclosures for various operating conditions.

For all the facts on Westinghouse manual controls, call the control sales engineer at your nearest Westinghouse office, The Man With The Facts!

J-30188

Westinghouse



### No More Searching for Covers!



#### SIMPLET

now packs covers with conduit fittings

for the popular LB, C, E,
T, LL, LR, and LRL types
IN NEW, ATTRACTIVE PACKAGES

You get the covers with the fittings . . . all in the same package . . . a convenience that saves you up to \$5, \$10, even \$20 a day in lost time searching for covers, extra handling, inventory space. No more ordering of covers and fittings separately, unless you prefer them that way!

What's more, these new, easy-to-identify packages are used for nearly all fittings in this broad, flexible line, assuring sturdy, damage-proof protection. Ordering and storing become effortless, simple procedures!

Outstanding features make your work easier

## 

- \* UL approved
- Made of cost maleable iron, strong—rugged durable
- More work area inside screws in corners no obstructions
- Ground surface for tighter cover and gasket
- Hooks and loops added to rectangular types as ordered
- · Fast delivery
- Field service help
- You get the fittings you want—no "extras" required

### GET THE CONVENIENCE OF THIS NEW PACKAGING NOW —

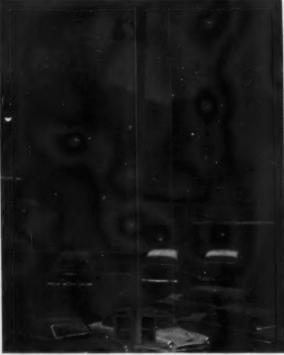
ORDER IDEAL-SIMPLET FITTINGS FROM YOUR WHOLESALER, TODAY!

IDEAL-SIMPLET FITTINGS, Inc.

A Subsidiary of Ideal Industries, Inc.
1041 PARK AVENUE, SYCAMORE, ILLINOIS



LINE VOLTAGE DROPS TO 80V ON SOLA CONSTANT-WATTAGE BALLASTED INSTALLATION: "Outages" are prevented due to the patented constant wattage circuit in Sola Mercury Vapor Lamp Transformers. Even when line voltage drops as low as about 75v on a 115v line, lamps stay lit, eliminating the need for "auxiliary" incandescent or fluorescent lighting installations.



LINE VOLTAGE DROPS TO 80V ON CONVENTIONALLY-BALLASTED INSTALLATION: Line voltage drops often cause outages. Until lamps return to strikeable condition, vital minutes of production time may be lost in industrial installations; safety hazards may exist in parking lots (as shown above) or playgrounds or plant area protection applications.

#### Sola Constant Wattage Transformers For E-H1 400w Mercury Vapor Lamps End Outages Due to Line Voltage Drops

When your mercury vapor lighting installation is ballasted with Sola Mercury Vapor Lamp Transformers, you can rely on dependably-maintained light output. First, outages are virtually eliminated since primary voltage must drop below about 75v on a 115v line before lamps extinguish. Second, the Sola Patented Constant Wattage Principle assures lumen regulation within  $\pm 2\frac{1}{2}\%$ , even in the face of line voltage variations as great as  $\pm 13\%$ .

In addition, Sola Constant Wattage Mercury Vapor Lamp Transformers offer the following advantages over conventional ballasts:

- Eliminate the need for primary taps . . . positive starting within the primary ranges of 100 to 130 and 200 to 260 volts.
- · Low starting current surge . . . line current during

- starting interval limited to effectively no more than normal full load value.
- Open and short-circuit protection . . . primary current positively limited under abnormal operating conditions of lamp failure, or external short circuit . . . constant wattage circuit eliminates any lamp electrode rectification.
- Extended lamp life . . . regulated voltage, current, and wattage permit continuous, stable operation, resulting in superior lamp life.
- Low crest factor... (peak/rms ratio) of lamp current averages only 1.7 at 115v primary supply.

It will pay you to investigate the advantages of Solaballasted mercury vapor lighting installations for both indoor and outdoor high intensity lighting applications. Request your Sola representative to call.

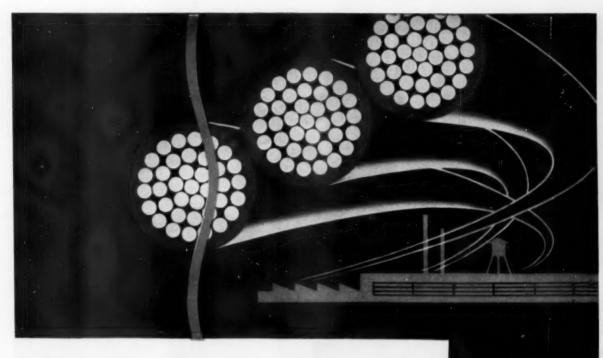
SOLA Mercury Vapor Lamp TRANSFORMERS



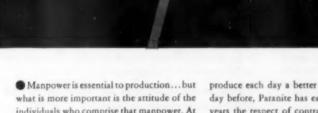


Write on your letterhead for Bulletin 17I-MV-219

CONSTANT VOLTAGE TRANSFORMERS • PLUORESCENT LIGHTING BALLASTS • MERCURY VAPOR LIGHTING TRANSFORMERS SOLA ELECTRIC CO., 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • NEW YORK 35: 103 E. 125th 51., TRafalgar 6-6464 PMILADELPHIA: Commercial Trust Bidg., Ritenhouse 6-4988 • BOSTON: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354 • CLEVELAND 75: 1836 Euclid Ave., PRospect 1-6400 • KANSAS CITY 2, MOJ. 400 W. 34th 51, Jefferson 4382 • LOS ANGELES 23: 3138 E. Olympic Blvd., ANgelus 9-9431 • SOLA ELECTRIC (CANADA) LTD., TORONTO 17, ONTARIO: 102 Laird Drive, Mayfair 4354 • Representatives in Other Principal Cities



### Paranite -- AND THE INVISIBLE INGREDIENT



individuals who comprise that manpower. At Paranite, you will find everyone sincerely interested in his part in the manufacture of our wire products.

This conscientious attitude is difficult to see . . . or feel . . . yet it contributes much to the high degree of perfection Paranite products have reached. This, we believe is another important phase of the invisible ingredient.

With an entire organization striving to

produce each day a better product than the day before, Paranite has earned through the years the respect of contractors and wholesalers everywhere. In fact, these men . . . having long experienced the dependability of Paranite wire products . . . coined a phrase: "If It's Paranite, It's Right!"

So specify Paranite, knowing that the wire and cable you receive is as nearly perfect as human hands can produce . . . utilizing modern equipment and cautious testing. This is the invisible ingredient . . . working for you!

#### PARANITE WIRE AND CABLE

DIVISION ESSEX WIRE CORPORATION

FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonssboro, Ind.; Marion, Ind.

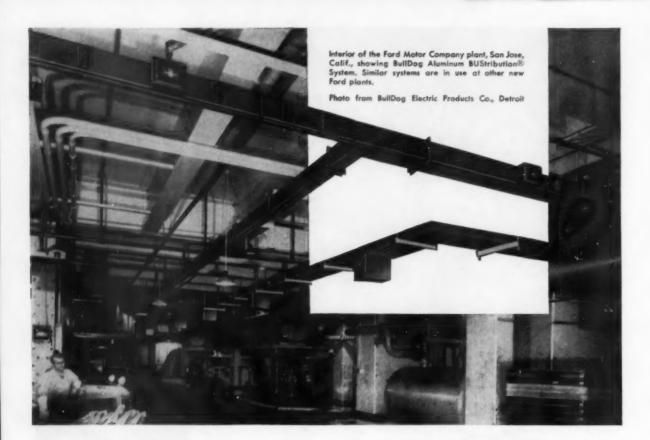
Warehouses\* and Sales Offices

\*Atlanta, Georgia, Boston, Massa-chuetts, \*Chicago, Illinois, Cleveland, Chouetts, \*Chicago, Illinois, Cleveland, Chouetts, \*Chicago, Illinois, Cleveland, Choo, Dallas, Texas; \*Detroit, Michigan, Hartferd, Connecticut, Indiana, Oragon, Upper Darby (Philameter, Connecticut), Indiana, Connecticut, Indiana, Connecti





outstanding!



### FORD INSTALLS BUSWAYS USING 1,500,000 POUNDS OF ALUMINUM CONDUCTOR

Installation costs less, provides more power per pound of metal. System is more flexible and operates with no increase in voltage drop or temperature rise over comparable copper system.

Since 1951, Ford Motor Company has been equipping its new plants with aluminum bus distribution systems. These include plants at Detroit, Chicago, Buffalo, Cleveland, Louisville and San Jose.

By switching to aluminum, Ford diverted more than 3 million pounds of critical copper to other uses. And Ford acquired a distribution system at lower cost.

Because aluminum is lighter, Ford received

more conductor per pound of metal...put less weight on the building superstructure.

Because aluminum costs less than copper, Ford received more conductor per dollar invested.

And these prefabricated conductors make a neat, safe, flexible installation that brings power to the job in any amount at any location. They can be readily moved to meet new power demands. Standard fittings, tools and methods are employed.

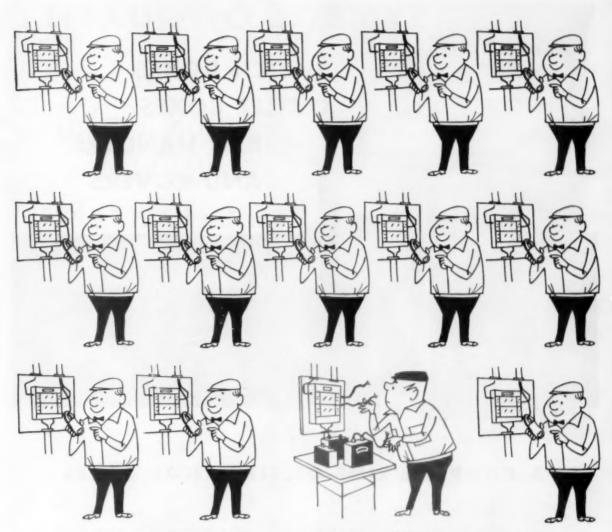
For more information on these modern packaged plant distribution systems, contact your nearby Alcoa sales office. Or write Aluminum Company of America, 2310-J Alcoa Bldg., Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value









#### Which electrician is doing it the hard way?

(Doesn't he know there's an Amprobe designed for his job and his budget)

There's no guesswork about current and voltage measurements when you're equipped with an AMPROBE. And when you're buying an AMPROBE, you can look over 13 different models before choosing the one that best serves your needs.

Choose your AMPROBE carefully. It'll save you time, money, and costly mistakes through the years. Whatever model you choose, you'll be able to meas-

ure voltage and current instantly, accurately, safely—without shutting down equipment. You can pick up an AMPROBE right now for as little as \$19.85...a complete volt-ammeter for only a few dollars more than an ordinary voltage-tester.

AMPROBE is a division of Pyramid Instrument Corp., Lynbrook, N. Y., manufacturer of REMCON simplified low-voltage switching devices.

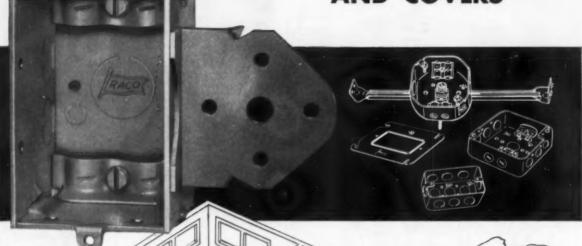
### **AMPROBE**

13 models to make your work easier, faster, surer

There's a model for every job, every budget: from 10 amps and 250 volts to 1200 amps and 600 volts AC; from \$19.85 to \$67.50.



# SWITCH BOXES OUTLET BOXES BAR HANGERS AND COVERS



#### A COMPLETE LINE OF ELECTRICAL BOXES

You can readily recognize the high quality of RACO products... beautifully finished ... smooth edges ... deep, clean-cut threads. Made of heavy gauge steel ... engineered to exceed local and national code requirements. On new jobs... on rewiring you can always rely on RACO. Write for complete information.



RACO

"A PACO BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. Aurora,

### NEW INTERIORS FOR OLD



ECONOMICALLY AND QUICKLY WITH THE

## Magic Coiling



Have some of your customers longed to glamourize their place of business with a luminous ceiling but balked at the price? Listen to this. The Magic Ceiling can transform a place of business practically overnight—at a cost that is pure magic. There must be a reason of course—and there is. In fact there are several. Let's examine all this magic.

is a stock item—a complete package of grid, channels, Wākon® diffuser, fluorescent lamps—delivered to your customer's place of business all ready to be installed on his present ceiling.

comes in a series of standard sizes (see table at right) designed to fit practically any size or shape of room. You just select the size you need and "float" it in. Installation is a breeze.

doesn't go wall-to-wall.

Think of the savings in material, complicated engineering, time and labor this means. Visual-

ize how it by-passes perimeter obstacles such as ducts, ventilators, shelving, etc.

gives beautifully diffused light of at least 50 footcandles if installed on a reasonably white ceiling. It covers up the old unsightly ceiling, conceals pipes, ducts, sprinklers. And all this with no dirt, sawdust or plaster. No masons. No carpenters. An electrician does the complete installation.

#### FIVE POPULAR SIZES

Magic Coiling Size	To Fit Room Approx.
9' x 8'	10' x 12'
9' x 12'	12' x 16'
12' x 16'	16' x 20'
15' x 16'	18' x 20'
18' x 20'	22' x 24'

Six other sizes available. See your Graybar mat

The Magic Ceiling is manufactured by Wakefield, a leader in lighting equipment for 50 years.

CALL GraybaR FIRST FOR

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, M. Y.



Offices and werehouses in more than 130 Principal Cities.

## Familiar symbols of safety.



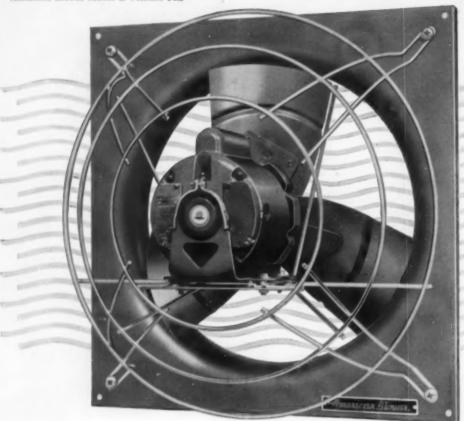
Wherever electrical wiring must function safely and efficiently in hazardous locations, install Youngstown Buckeye rigid steel conduit. It is easy to bend ... easy to fish wires through ... and economical, because its greater corrosion resistance means a longer, trouble-free service life. When you install Buckeye you're one of thousands of contractors, owners and architects who make it one of the world's best known brands of standard-threaded, full-weight rigid steel conduit.

#### THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Ask your distributor for
Youngstown Buckeye Full
Weight Rigid Steel Conduit
and
Youngstown Electrical
Metallic Tubing.





## Streamline inlet gives higher efficiency, quieter operation

This is only one of many engineering and design features which make American Blower Ventura Fans a popular choice for all types of commercial and industrial applications—from cafeterias and laundries to sales rooms and warehouses.

Ventura Fans operate quietly as they whisk away stale air or fumes; have certified ratings; come in a wide range of sizes and models. Fact is: American Blower has a complete line of propeller fans—as well as blowers, attic fans, and home ventilators . . . a good reason why it pays to standardize on American Blower.

Why not call our nearest branch today for full information.

#### IT PAYS TO STANDARDIZE ON THE AMERICAN BLOWER LINE!

- Ventura Fans for efficient commercial and industrial ventilation; propeller type; 10 to 72 inches.
   Certified ratings.
- Utility Sets for general supply or exhaust duty, Ratings certified; self-contained. Sirocco wheels, 3 to 36 inches.
- Aeropel Home Ventilators for use in kitchens, bathrooms, recreation and laundry rooms. Attractive design; quiet; easy to install.
- Attic Fans for comfort cooling at low cost in homes, apartments, hotels. Ratings certified; vertical or horizontal models.

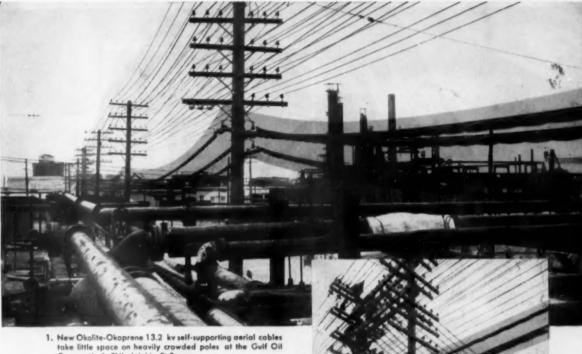
AMERICAN



BLOWER

Division of AMERICAN - Standard

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN . CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO



Corporation's Philadelphia Refinery.

2. Primary distribution circuits in conduit leaving substation and rising in conduit to poles.

### REFINERY EXPANDS POWER DISTRIBUTION with OKOLITE-OKOPRENE SELF-SUPPORTING CABLES

A major increase of power line capacity utilizing heavily crowded existing poles at the Gulf Oil Corporation refinery in Philadelphia was made possible by the use of Okolite-Okoprene self-supporting aerial cables. The 15 ky shielded construction permitted easy, rapid installation despite the presence of "hot" lines on the poles which could not be shut down during the job.

The neat appearance, increased safety and space savings obtained through the use of selfsupporting aerial cables are evident in this installation. In addition, simplicity of installation and ease of handling mean lower construction costs. Okolite-Okoprene is also well known for its resistance to weather extremes, moisture, most oils and greases, and the common acids and alkalies.

Write for Bulletin EC 1074, for detailed information on Okolite-Okoprene self-supporting aerial cables to The Okonite Company, Passaic, N. J.

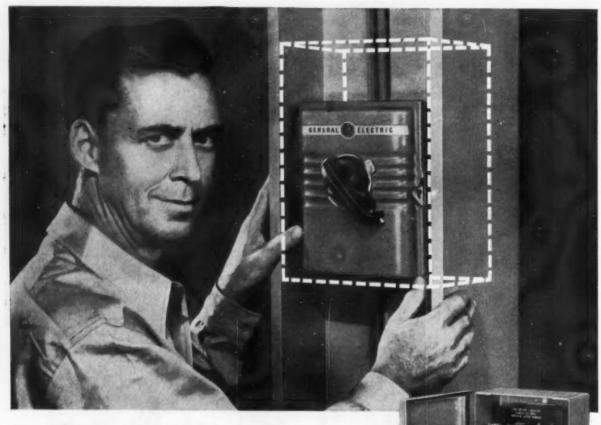
Electrical Contractors: W. V. Pangborne and Co., Inc.

Available with either copper or aluminum conductors





ONITE insulated cables



Now you need only half the former space with General Electric's new 30 amp, 600 volt HCl safety switch!

ated handle makes close ganging easy with the heavy duty model; front fusing on both models means fast access to fuses, efficient heat dispersal. Double-break HCI pole units can be individually replaced.

Better protection, greater safety. Quick-make, quickbreak contacts can't be teased in or out. Switch handle locks OFF or ON. When switch door is open, special line shield on heavy duty model guards operator against accidental contact with live parts. General Electric Company, Circuit Protective Devices Department, Plainville, Conn.

This HCI safety switch, both heavy and standard duty, has a new compact design measuring only 73/4" wide x 93/4" high x 53/4" deep! In less than half the former space, you get the same dependable protection and these important benefits:

Long life, dependable performance. G-E arc quenchers quickly divide and snuff out arcs, help prevent pitting and burning of contacts. Heavy steel box has Bonderite! corrosion-resistant finish and butt-hinged door for rugged durability.

Speedy installation and maintenance. Front oper-

Use these catalog numbers to order 30 amp, 600 volt HCI switches from your G-E Distributor:

Type H, heavy duty, front operated, 3 pole*		Type S, standard duty, side operated, 3 pole		
Fusible	No fuse	Fusible	No fuse	
TC903615D	TC453615D	TC60361	TC30361	

Parker Rist Proof Co.

\*UL listed



## Sikorsky Aircraft's "Plant of the Year"



## WIRE BY PHELPS DODGE

This spacious new helicopter plant recently built by Sikorsky Aircraft, division of United Aircraft Corporation in Stratford, Conn., covers nearly 18 acres and can easily be expanded to meet future production needs. A model plant in every respect, it has been cited by Factory Management & Maintenance as one of the top ten in the nation for 1956.

One of the requirements for this outstanding Sikorsky plant was an electrical system of the highest quality. That's why Phelps Dodge building wire and cable were installed.

On every wiring job where top-quality performance, expert workmanship and experienced "know-how" are called for, it pays to rely on Phelps Dodge and your Phelps Dodge distributor!



### PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallos, Detroit, Fort Wayne, Greensboro, M. C., Mouston, Jacksonville, Konsas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochetter, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

# Remarkable New Hides Completely.

# NEW multi-vent TROFFERLITE THE DUAL PURPOSE FIXTURE WITH 8 OUTSTANDING ADVANTAGES

FOR ARCHITECTS

Insures clean functional ceiling design.

FOR ENGINEERS

Simplifies planning.

FOR CONTRACTORS

Simplifies field installation.

- Air is gently diffused downward using pressure displacement principle, instead of high velocity air injection. Results: draft-free air conditioning.
- 2. Fewer fixtures and fewer installations needed, because air diffuser and illumination are in the same fixture. Big savings!
- Temperatures remain uniform throughout the room. The pressure displacement principle simplifies field balancing.
- 4. Makes in-progress or after-completion changes easy and economical, with little inconvenience.
- 5. No dirt smudges on adjacent ceiling materials.

- 6. Partitions can be moved without interfering with air conditioning efficiency. There is no "throw" or "blow" because air is gently diffused downward.
- 7. Clean ceiling design . . . only the modern light fixture shows in the ceiling . . . no air diffusers. Highly efficient units provide control illumination for any lighting situation.
- 8. Concentrate air conditioning where you need it, over "hot" spots (where people or machines are concentrated). Conversely, where minimum air conditioning is needed, fixtures can remain unattached to air duct, or shut off.

IDEALLY SUITED FOR APPLICATIONS IN:



OFFICE BUILDINGS AND STORES

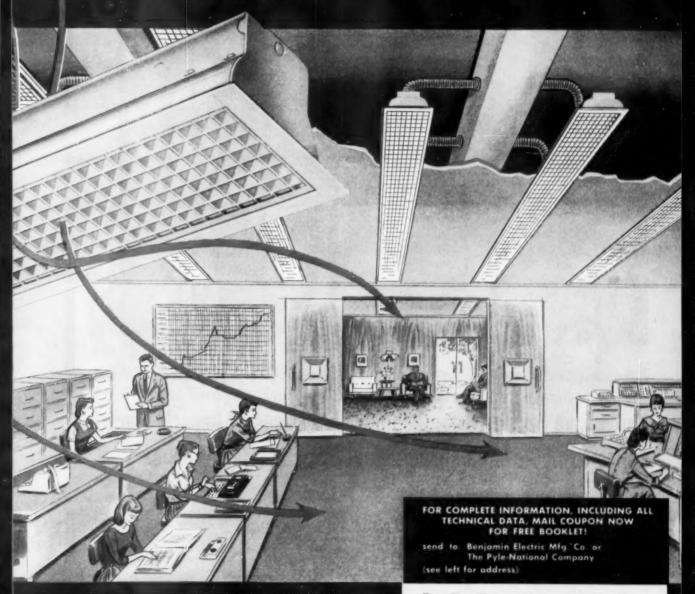
HOSPITALS

SCHOOLS

HOTELS AND RESTAURANTS

LABORATORIES

## Air Diffuser . im a light fixture?



Jointly designed and engineered by

BENJAMIN ELECTRIC MFG. CO.

Des Plaines, Illinois

AND

The PYLE-NATIONAL COMPANY

Chicago 51, Illinois

Dear Sirs: Please send me your free booklet on the Multi-Vent Trofferlite, the light fixture that diffuses conditioned air.

NAME\_

FIRM NAME

ADDRESS\_

CITY\_

STATE\_

#### G-E LAMPS GIVE YOU MORE FOR ALL YOUR LIGHTING DOLLARS



## You'd have to search through all these cases of General Electric lamps to find even a single defect affecting performance

GENERAL ELECTRIC UNIFORMITY IS WHY—Each of these 42 cartons contains 24 G-E 40-watt fluorescent lamps. That's 1008 lamps! And they average a 99.9% freedom from physical defects that affect performance in service.

G-E LAMPS SAVE YOU MONEY—Replacing lamps that do not work properly due to physical defects can be expensive. In more ways than one. Often an electrician has to be called. That costs money. Work often suffers while the lamp is out. Even more expensive. And work is interrupted while the lamp is replaced. Add it all up and it's too much money. Make sure your lamps are free from costly physical defects by always specifying G-E lamps.

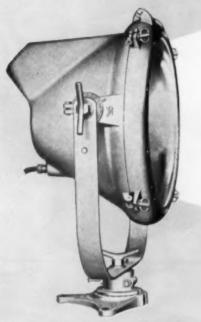
But General Electric lamp uniformity means more than freedom from defects. You can also count on uniform light output—less than 1% of all G-E 40-watt fluorescent lamps are as much as 5% below their published light output of 2500 lumens. And uniform life, too, means that after one year of service in single shift plants (2500 hours) an average of 99 out of 100 General Electric lamps will still be burning—98 out of 100 will still be in service after a year in double shift plants (4000 hours).

For more information on what uniformity in G-E fluorescent lamps means to you write: General Electric Co., Large Lamp Dept. EC-9, Nela Park, Cleveland 12, O.

Progress Is Our Most Important Product



### Still on the job ... AFTER 30 YEARS!



New 20" Floodlight, Type 20175



#### **PYLE-NATIONAL Enclosed Cast Aluminum**

## FLOODLIGHTS

Pictured above is a night view of the Wrigley Building, Chicago, one of the early installatons of Pyle-National flood-lighting. The original lights are still on the job even after having been loaned to the Navy during the war. When reinstalled, total cost of replacement parts was less than \$2.00!

This is a remarkable example of the long-range economy and efficiency you can expect from high quality enclosed aluminum floodlights.

Fourteen models to serve every need.

- · WATER-TIGHT
- · DIRT-TIGHT
- CORROSION-PROOF
- HIGH EFFICIENCY
- LOW MAINTENANCE

Literature furnished on request.



#### THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL 1344 North Kostner Avenue, Chicago 51, Illinois

Branch Offices and Agents in Principal Cities of the U.S. and Canada • Canadian Agent: The Holden Co., Ltd., Montreal Railroad Export Department: International Railway Supply Co., 30 Church St., New York 7, N.Y. Industrial Export Department: Rocke International Corp., 13 E. 40th St., New York 16, N.Y.

### INTRODUCING ELECTRIC STABREAKER FOR "ON THE SPOT" PANELBOARD DELIVERY Save Delivery Save Reduce Breakage Time Money and Loss with STABREAKER "over-STABREAKER protects your labor and invest-STABREAKER cuts down the-counter" panelboard service. Fill power disinstallation time to save you money! Simply buy ment by enabling you to tribution panelboard rethe enclosure and roughplug-in the panel interior

Finest Products Engineered FEDERAL

quirements INSTANTLY ...

directly from stock.

wire. Later plug in breaker to complete job.

after all other construc-

tion work is done.

## STABREAKER\*

With the Shape That Gives
AB Circuit Breakers
PLUG-IN Flexibility!

"Stabs" added to AB Circuit Breakers give you the first PLUG-IN type AB Circuit Breaker ever developed — STABREAKER! With the simple addition of "stabs" to its regular "NE", "NF" and "NJ" molded case circuit breakers, Federal Pacific offers new economy . . new flexibility in providing STABREAKERS for panelboards and for individually enclosed circuit breakers. All of the proved advantages of Federal Pacific's type AB molded case circuit breakers are retained in the new STABREAKER design . . assuring you the same dependable performance with a big plus in flexibility.

#### STABREAKER FOR UNMATCHED AB-I FLEXIBILITY



#### Simple Interchanging of Ratings

Pull out present breaker; disconnect load side wiring; plug in new rating in same frame size; rewire and job is done.



#### Visual Certainty of Breaker Disconnect

With STABREAKER YOU SEE THE DISCONNECT! Just pull out the breaker and let it hang by the load wires



Greatly Simplified Installation

Breakers, enclosures separately packed. Empty box provides ample wiring space. Breakers plug in effortlessly.



#### Maximum Flexibility

NE-S, NF-S and NJ-S STABREAKERS used in one of two NEMA 1A enclosures. One enclosure for both NE-S and NF-S.

#### PACIFIC ELECTRIC COMPANY

50 Paris Street, Newark 1, N. J.





beyond the Call of Duty-on-the-Job ...

### **KILLARK ELECTROLETS ARE STRONG**

KILLARK
ELECTROLETS
ARE
UNCONDITIONALLY
GUARANTEED
AGAINST
BREAKAGE

#### Here's why:

- num alloy blended to give strength and malleability. Alumalloy is not brittle but ductile and resilient; it resists shock and strain far beyond actual needs.
- are engineered for maximum strength, reinforced at points of stress, designed to utilize maximum metal strength, and are Underwriters' approved.
- pounds of pressure are used in the die-casting process to give a tougher, closer-grained metal.

"Killark . . . a fitting name to remember"

#### ELECTRIC MANUFACTURING COMPANY

						,
SALES OFFICES and WAREHOUSE STOCKS	Atlanta Boston Buffalo Chicago Cincinnati	69 Mills St., N. W. 49-51 D St. 278 Johnson St. 1528 West Adams St. 1031 Meta Dr.	Dallas Denver Detroit Los Angeles	1901 Griffin St. 1073 Gelepego 8319 Mack Ave. 412 Seaton St.	Pittsburgh Son Francisco	2014 Chancellor St. 4830 McKnight Road 714 Harrison St. 4130 First Ave., So.
SALES OFFICES	Baltimore Columbus	11 W. 25th St. 2700 E. Main St.	Kansas City, Ma. Minneapolis	616 W. 26th St. 826 Andres Bldg.		600 W. 181st St.

Sales Offices and Warehouse Stocks throughout Canada





#### Install **ECON** Dual-Element Cartridge Fuses

Workers and management both lose when harmless overloads cause needless fuse blows, resulting in "down time" and lost production. Econ Dual-Element Cartridge Fuses on motor and branch circuits offer *Double* protection: "timed" protection against overloads... and instantaneous action on shorts. Only ECON Fuses have Econ-Alloy Thermo Element that gives the fullest protection against fuse failures.

Sold through wholesalers since 1911

ECONOMY tuses for every purpose

ECONOMY FUSE & MFG. CO., 2717 Greenview Ave., Chicago 14, in



## Week-end wiring "experts" After your job?

Plenty of homeowners today know that their houses need better wiring. Poor performance of their air conditioners, broilers, television sets, dishwashers and other appliances drives the point home.

But too many think that they can make out with a little "week-end wiring" here and there. They tackle jobs that should be done only by a qualified electrical contractor.

Now is the time for you to sell them a complete rewiring job that's troublefree because it's done right. With proper "selling," they're probably your biggest, readiest source of new business.

When you sell modernization, make a point of modern materials . . . wire and cable insulated with BAKELITE

Vinyl Plastic. You can safely assure customers that it will far outlast older types because it resists oxidation, stiffening, and cracking—keeps its electrical and physical properties for years longer.

Bakelite Brand Vinyl Plastic makes your installation job easier, too. This thin-walled insulation makes stripping and splicing faster and cleaner because individual conductors have no fabric or saturating compounds. It's listed by UL for 60 deg. C. (140 deg. F.) building wire and for non-metallic-sheathed cable, including the new all-plastic types UF and NMC. Ask your supplier about the many advantages of this modern insulating material that helps you sell, helps you install modern wiring.



Remember-everyone benefits from ADEQUATE WIRING Insulated with BAKELITE Brand Vinyl Plastic

BAKELITE COMPANY, A Division of Union Carbide and Carbon Corporation [17] 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.



#### eliminate switch failures with THE SWITCH THAT'S always & READY

Pampered in production to withstand abuse in use, the Levolier® #41 switch retains its positive action even after hundreds of thousands of pulls. It is uncondi-tionally guaranteed against failure in lighting circuits. Its one-piece molded phenolic case insures better insulation, makes wiring easier. Removal of the mounting nuts lets the mechanism slip out, exposing terminals. A 6 amp "T" 125 volt switch, it is only 5%" x 13%" x 13%". Ideal for individual control of lighting fixtures.



Whether you prefer universal lever or the new push button control, you can have a Levolier Lampholder that has a proven record of long service in strenuous

industrial use. Levolier switch mechanisms are built into both brass and molded phenolic heavy duty lamp-holders in a variety of single or two circuit models. All are built to eliminate failures in plant and machine lighting that can mean costly production time losses.

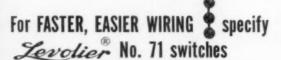








The Levolier® No. 25 Toggle Switch is "T" rated for 6 amps — 125 volts and especially dependable for FHP motors on quality appliances, portable tools and for panel boards. Only V<sub>2</sub>" thick, V<sub>2</sub>" wide and 1" long. The molded phenolic case is dust and vibration proof. 6" wire leads with choice of colored levers for easy identification of circuits. Available also in three way and two circuit models with lugs or screw ter-



A single pole, single circuit switch, the Levolier® No. 71 model is the thinnest 6 amp "T" 125 volt switch on the market today. Only 15/32" thick, it insures quicker and easier installation because of the 6" wire leads that are permanently fastened to the terminals by pressure connections. Standard finishes: brass, dark bronze and burnished nickel, with brown molded phenolic case. The No. 71, like all Levolier switches, is Underwriters' approved.

We GILL. SPECIALTIES

are always a little better and ALL are Underwriters' Laboratories Inspected



**Available through leading** Electrical Wholesalers

> formation on McGill Electrical Products, write today for the new Catalog No. 84.

McGILL MANUFACTURING COMPANY, 450 N. Lafayette Street, Valparaiso, Indiana



PACKAGED **Motor Starter** PARTS!



SH BUTTON KIT

OTHER KITS ... Selector Switches Interlocks Replacement Parts Contacts Coils



#### EASY to Identify!

Easy-to-read catalogs, simplified motor control and overload relay selectors, illustrated service bulletins...these all combine to assure quick changes through easy parts identification.

START

STOP

#### EASY to Buy!

Conveniently packaged and labeled conversion parts are immediately available "off-the-shelf" from nationwide network of authorized Square D electrical distributors.

#### FASTER to Install!

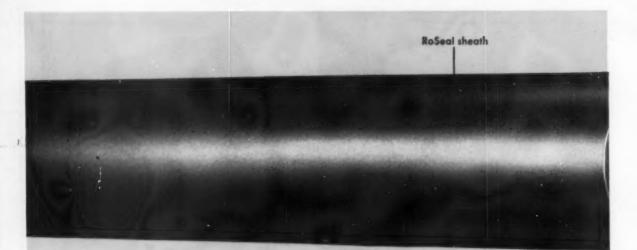
Conveniently packaged parts can be installed using only a screw driver and without disturbing any wiring.

Write for Bulletin 9999. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE I



SQUARE D COMPANY



RoZone-RoSeal shielded power cable for high-voltage applications through 15 kv.

# How this new high-voltage



Workers at the new St. John's Hospital in Tulsa, largest in Oklahoma, connect basket grip to three RoZone-RoScal cables. They will draw cable from underground switch vault to surface and power transformers.

specified RoZone-RoSeal . .



Here, workers begin to feed RoZone-RoSeal cables into conduit inside underground vault. St. John's Hospital uses RoZone-RoSeal cable buried underground and in conduit inside hospital.

"Regarding our choice of RoZone-RoSeal cable for St. John's Hospital:

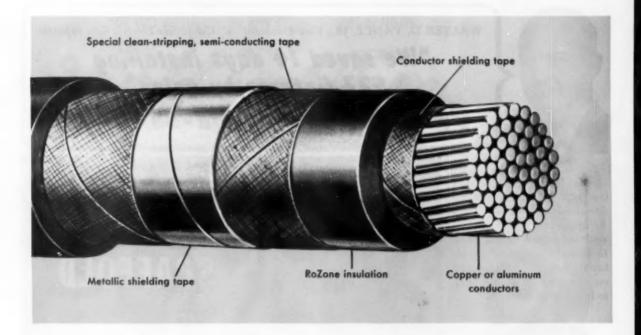
"We can tell you that due to the nature of the building, extreme reliability was Why an architect the first consideration.

"Closely following were the requirements of moisture resistance, inductive capacity in the configuration as laid, and uniformity of product.

"We found that a specification built around Rome Cable's RoZone-RoSeal satisfied all the above."

JOHN C. PENAFEATHER, Mechanical Engineer

LEON B. SENTER, A.I.A., Tulsa, Oklahoma



# construction gives you quality at low cost

#### What is RoSeal?

It's a special flame-resistant polyethylene compound we developed as an over-all sheath for insulated cables.

#### What Is RoSeal's cost feature?

RoSeal costs less than most conventional thermosetting nonmetallic sheaths—a fact that's reflected in the lower cost of the finished cable, such as RoZone-RoSeal.

#### How does RoSeal compare with thermosetting nonmetallic sheaths?

- 1. Greater moisture resistance.
- Equivalent resistance to weathering and soil conditions.

- Easier pulling and bending. Because of its waxy structure, RoSeal has a lower coefficient of friction than any other sheathing material. It bends easily at temperatures as low as -40°C.
- Good resistance to abrasion, crushing, and impact.
- 5. Equal durability and life span.
- 6. High resistance to chemicals and oils.
- 7. Inherently high corona levels on power cables.

#### Where can you use RoSeal?

Anywhere—in the air, in conduit and ducts, direct in earth, even in water.

#### How can you find out more?

Simply write for Bulletin ROT-1.

It costs less to buy the best



WALTER D. VANCE, JR., Vice President . California Electric Co., reports:

"We saved 14 days installing
527 fixtures by using
"UP-RIGHT' Scaffold-on-Wheels"

Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.

14' tower assembled in 2 minutes

Rolls with job

Scaffold carries fixtures



For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC GOES FURTHER STICKS FAST-IN ANY WEATHER GUARANTEED **FOOTAGE** WON'T RAVEL TEARS EVENLY

#### BEST BUY FOR PLANT SUPPLY

All types of GOLD SEAL TAPE — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls.

Every roll cellophane-protected, stays fresh.

Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

#### DIAMOND SEAL

Friction and Rubber Tapes are also made by Jenkins Bros. to ASTM specifications.



#### Easy on the Eyes and the Lighting Budget

#### ... Another Installation by LITECONTROL

This installation gives the Bridgeport, Connecticut office of Sun Oil Company a "sunny disposition" without glare. It represents a team job of customer, project engineer, contractor and Litecontrol and shows what can be done to achieve a custom look with standard Litecontrol fixtures.

Walls are light green, floor is gray and red and the ceiling is natural white acoustical tile. Litecontrol's curved lens, 2-lamp slimline troffers with Holophane 9033 and 9034 low brightness lenses have eye-appeal as well as eye *protection*. The fixture fits in any ceiling having a 12 inch opening, although it is not designed to snap in. Lenses lift easily and tilt for removal and easy servicing.

Litecontrol has a complete line of fixtures which through high efficiency, low brightness and ease of installation and maintenance save sight and money. Let us prove it to you on your next job.

I NSTALLATION: Sun Oil Company, Bridgeport, Connecticut AREA: General Office

PROJECT ENGINEER
Alex M. Engart, Engineering
Department, Marketing Division
Sun Oil Company
ELECTRICAL CONTRACTOR:
Walsh Electric Company,
Easton, Connecticut

Easton, Connecticut
FIXTURES:
Litecontrol #5524 2-lamp slimline troffers with
Holophane #9033 and #9034 low brightness

CEILING HEIGHT: 10'-0" FIXTURE SPACING 8'-0" on centers

INTENSITIES: 45 footcandles average in service



#### LITECONTROL Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

if it's a fitting...

Ecor

for <u>every</u> ble size!



# ADEQUATE WIRING

sizes ...

2 - #3 and 1 - #5

2 - #3 and 1 - #3

2 - #2 and 1 - #4

2 - #1/0 and 1 - #1/0

#### service entrance cable sizes with applicable

CABLE SIZE	SERVICE ENTRANCE CAP	STRAP	NON WATERTIGHT CONNECTOR	WATERTIGHT
1 #12 & 1 #12 1 #10 & 1 #10 1 #3 & 1 #8	ESC 802 ESC 802 ESC 5	860 860 860	1111 1111 1111	839 839 838
1 #6 & 1 #8 1 #6 & 1 #6 1 #4 & 1 #6	ESC S ESC S	860 860	1111 1111 1212	838 838
1 #4 & 1 #4 1 #2 & 1 #4 1 #2 & 1 #2	ESC 5 ESC 5 ESC 5	19 230 230	4234 4234 4234	Ξ
2 #12 & 1 #12 2 #10 & 1 #10 2 #8 & 1 #8	ESC 5 ESC 5 ESC 5	860 861 861	1111 1111 1234	850
2 #6 & 1 #8 2 #6 & 1 #6 2 #4 & 1 #6	ESC 5 ESC 5 ESC 5	861 861	1234 1234 3410	851 840 849
2 #4 & 1 #4 2 #3 & 1 #5 2 #3 & 1 #3	ESC S ESC S	861 861 861	3410 3410 3410	849 854 854
2 #2 & 1 #4 2 #2 & 1 #2 2 #1/0 & 1 #1/0	ESC 803 ESC 803 ESC 804	862 862 23	1015 1015 1015	859 859 858

Figures in blue denote new "Adequate Wiring" service entrance cable sizes.





#### First and foremost in fittings - sold exclusively through electrical wholesalers



Dept. A, 37-50 57th St., Woodside 77, New York

Send complete data on service entrance cable fittings.

NAME

TITLE

ADDRESS

CITY ZONE STATE

# SMOOTH BORE!



#### Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from

corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

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ORANGEBURG MANUFACTURING CO., INC., Grangeburg, N. Y.

West Coast Plant, Newark, Calif.

ORANGEBURG®

SELF SEALING

TAPER JOINT

#### HERE'S HOW THE ADVANCE SERVICE-STOCKING DISTRIBUTORS' PLAN WORKS TO BENEFIT YOU



ADVANCE TRANSFORMER COMPANY has appointed over 600 Service-Stocking Distributors throughout the United States who are participating in this nation-wide program. These authorized distributors carry a complete stock of all popular ADVANCE ballasts to give immediate replacement service for

any make fluorescent lamp ballast whenever replacement is necessary. Simply bring the inoperative ballast to any ADVANCE Service-Stocking Distributor. The ADVANCE cross-reference guide shows at a glance the replacement needed, and in a few moments, you can be back on the job with the correct ballast.



All ADVANCE fluorescent lamp ballasts carry a two-year warranty and are replaced without charge. The ADVANCE label is your assurance of dependable, efficient performance at lowest cost . . . the result of years of research, engineering and development.

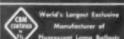


for complete details.

The Heart of the Lighting Industry



ADVANCE



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. . if you are not now utilizing the ADVANCE

Service-Stocking Distributors' Program, write today

#### Another TRIANGLE Multiple Product Job



The J. L. Hudson Eastland Shopping Center, Detroit, will cover 500,000 square feet. It was designed by Victor D. Gruen Associates, Detroit, Hyde & Bobbio, Inc., are the Bechnical and Electrical Engineers and the Electrical

#### J. L. Hudson builds \$28,000,000 Shopping Center

The Motor City is getting a new look. The new \$28,000,000
J. L. Hudson Eastland Shopping
Center will soon be open to provide luxury shopping facilities for busy Detroiters.

When completed, the new Center will have space for seventy stores and parking room for 5,000 cars.

The Center is a masterpiece of modern design and development. It is scheduled for opening in 1957. All stores will be completely Air Conditioned and the grounds surrounding them will be beautifully landscaped.

#### TRIANGLE ordered for the job

Naturally, such a development called for extensive wiring—flexible and rigid conduit, cable and building wire. And the contractor knew just where to get it. Triangle!

That's because Triangle is famous for the finest quality products that research and modern equipment can produce. And at Triangle the engineers knew they could get everything they needed-when they needed it.

The entire job was serviced through a nationally recognized distributor. Triangle is nationally distributed and representatives are located in principal cities in the United States. For your next installation, you'll find it pays to call Triangle.

# 346,000' of TRIANGLE Wire and Cable 346,000' of Rigid and Thin Wall Conduit... 32,000' of Plastic Conduit...

for the new J. L. Hudson Eastland Shopping Center

That's how much top-quality electrical material will go into this new luxury shopping Center.

Seems like a lot, but not by Triangle standards—they are accustomed to filling big multiple product orders, and on time! Modern equipment, strict supervision and skilled workmen guarantee that. And that's why Triangle is considered one of the top companies—the men who specify know "it must be right" if it's Triangle.

Let's take a Quick Look at TRIANGLE



Up to date research



Ever expanding plants



Large stocks in redistribution centers



the Triangle trademark your guarantee of distinctive quality

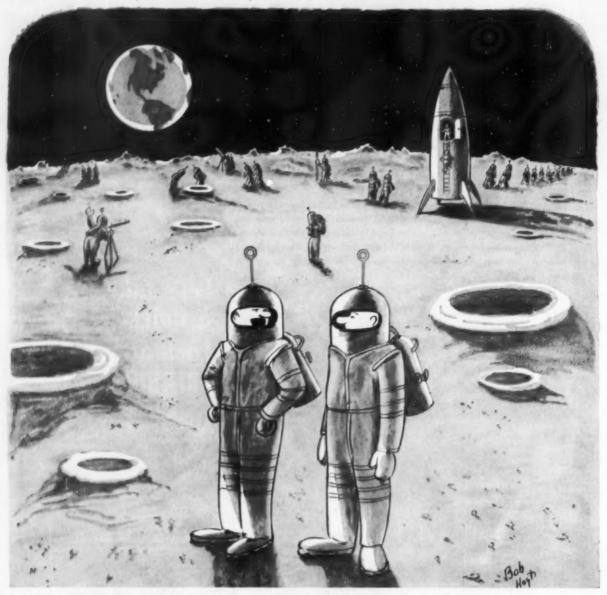


TRIANGLE

Conduit and Cable Co., Inc.

NEW BRUNSWICK, NEW JERSEY

One in a series to emphasize the economy of Electrical Wholesale Distribution



#### "We can't afford to settle permanently now, Wilcox we don't have any Electrical Distributors with us."

"Electrical Wholesaler Distribution reduces the Manufacturer's selling cost and thereby reduces the selling price of electrical supply material to the user. Therefore, our policy has been to distribute Thomas & Betts products exclusively through the Electrical Wholesaler."\*

LOOK FOR THIS SIGN -



IT'S THE MARK OF AN AUTHORIZED T& B DISTRIBUTOR

#### THE THOMAS & BETTS CO.

INCORPORATED

34 BUTLER STREET, ELIZABETH 1, NEW JERSEY
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

\*Quoted from the T & B Plan of Wholesaler Distribution. If you would like to know the complete story of the T & B Plan, write:



## CRESCENT



#### INTERLOCKED ARMOR POWER CABLE

Can Be Easily and Quickly Installed . . . Saving Both Time and Money

Crescent Interlocked Armor Cable with ALUMINUM or GALVANIZED STEEL AR-MOR provides a flexible metal-enclosed method of wiring for power. Speed and economy of installation are the principal advantages of these cables since they can be placed on easily hung racks or attached to building surfaces. Maximum

the use of the varnished cambric insulation. For outdoor or damp location installation, it is furnished with SYNTHOL IMPERVIOUS SHEATH between the insulated conductors and armor, as illustrated below.

#### INTERLOCKED ARMOR CABLE

WITH IMPERVIOUS JACKET

Three Conductor-VARNISHED CAMBRIC INSULATED-O-5000 Volts



The Varnished Cambric insulated conductors are thoroughly protected by the Impervious Sheath of tough thermoplastic which is highly resistant to moisture, alkalies, acids and oils. This cable shows attractive savings when strung from messenger cable or in troughs outdoors as between buildings.

WRITE FOR BULLETIN

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON 5, NEW JERSEY

# GEDNEY'S RIGHT THERE IN YOUR CORNER

helping save time . . . hold down costs

CORNER FITTINGS? Well, here are three that have proved immensely popular for the simple reason they're easiest to install—save time and labor that really counts up. Like the

rest of the full Gedney line they're made of unbreakable malleable iron...accurately machined and threaded...individually inspected. Order Gedney—always—for lowest installed costs!



#### 90° CORNER ELLS

Fitted with gasketed cover. Both ends female. Made of malleable iron, cadmium plated. Available in a full range of sizes from ½" to 2".



Fitted with gasketed cover. One end male, one end female. Made of malleable iron, cadmium plated. Your choice of sizes from 1/2" to 2".



#### CORNER PULL-IN CONDUIT ELLS

Today's top specification for space-saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated. Sizes run from ½" to 2".



# GEDNEY FITTINGS FIT

GEDNEY



RKO BLDG. • RADIO CITY • NEW YORK 20 foundry, Factory and Shipping Point: Terryville, Conn.

#### Crisis in Estimating

The brilliant work of Ralph E. Johnson of Denver culminating in "Estimatic" is a significant break-through in electrical estimating practice. It is described elsewhere in this issue. It spotlights at a crucial time a key problem in construction generally, but more acute in electrical work because of its rapid advances in technology and utilization.

How acute can be surmised from B. C. Cooper's statistical summary, this month, which discloses a growth pattern in construction that has persisted through a decade. The growth in electrical work is even greater percentagewise as utilization advances require higher system capacities. Barring some unforeseen economic collapse, the gains can be confidently projected well into the future.

Traditionally, electrical work in new construction is negotiated by competitive bids which place a firm value in dollars and cents on the proposed work. Thus the estimate, from which the bid is derived, is a critical instrument in sales. The perception and accuracy of estimators together with the business judgment of management can decide the economic well-being of the industry.

Estimating is a highly responsible and peculiarly exacting task. It takes an unusual combination of technical education, training, practical experience and judgment. Men of even basic qualifications are scarce and training takes a long time. Prospects that the industry can meet its growing market with equivalent expansion in trained estimating personnel are highly improbable.

Johnson's estimating system is a head-on attack on the problem. It saves the estimator's time and relieves him of much tedious routine. Widely used, it would have the effect of considerably increasing the capabilities of existing industry personnel.

The long range aspects of the role of estimating in electrical construction, particularly its use for competitive bidding, deserves further exploration. Some astute buyers today choose their electrical contractor by reputation, experience, organization and services. They consider these matters more relevant to performance than the contractor's ability to pick the right number in a price contest. More extensive use of such criteria would certainly encourage more constructive use of estimating skills.

Organizations of experienced, highly-trained people provide the coordinated technical and management services which are basic to the economy and progress of this industry and its service to the public. Dissipation of scarce talents into great numbers of fruitless lotteries to preserve the traditions of competitive bidding is a continuing waste that the industry can ill afford.

Um. V. Stuart



Wrenches to wire pullers-tools that help make better workers and smooth operations are quickly available via Graybar. Your local Graybar Repre-

sentative will be glad to help you select tools in a size, capacity and ability

#### TOOLS for MAINTENANCE—CONSTRUCTION—PRODUCTION

#### - from over 130 Graybar locations

Tools that help get the job done faster are available from Graybar offices and warehouses located in the principal cities of the nation.

A phone call brings prompt attention. Every Graybar location is geared to give you accurate price, specification and delivery information on hand. mechanical and motor-driven tools.

You save buying time, paper work and avoid delays through Graybar's centralization of order assembly, shipping and billing procedures.

You get up-to-date tools of proven design and construction for hard usage-all products of well known manufacturers.

You'll discover that Graybar is the most convenient single source of everything electrical. We welcome your inquiries, both large and small. Graybar Specialists in the major electrical fields are available to advise and consult with you and your customers.





Users of electrical equipment in U.S.A. and possessions can have a free copy of this catalog - one of the most comprehensive on electrician tools ever published. Send us your name, firm, and address.

GraybaR FIRST FOR



GRAYBAR ELECTRIC COMPANY, INC., 426 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

IN DENVER

# ESTIMATIC . . . Applies High Speed Automatic

#### **Business Machines to Electrical Estimating**

Estimatic, electrical estimating employing automatic machine data processing, is the first major change in electrical estimating practice since the introduction of labor units more than 30 years ago. The new method is the culmination of three years of effort by Ralph E. Johnson, president of Sturgeon Electric Company, Inc. of Denver, Colo., and his associates. It cuts estimating time by 50 to 70% and relieves estimators of most of the paper and figure work commonly associated with accurate estimating.

By W. T. Stuart

T WORKS like this. The estimator proceeds normally through plan and specification study, layout, notes and preparation for takeoff. Take-off resembles conventional practice, but the Estimatic estimator lists standard operations based upon installation standards set forth in a large manual. Each of these installation standards is identified by a code number. A standard may contain only one or as many as 18 different products in the assembly. The resulting takeoff sheet will show quantities of each assembly represented by a ten digit code number.

From here on machine data processing takes over. An operator copies the take-off on a keyboard. Each item is typed and punched into a card; the complete take-off becomes a stack of punched cards. Handled through several automatic machines, the take-off rolls out of a printing tabulator, is priced, extended, totalled and summarized.

The stack of cards are again processed by a different automatic routine. A complete bill of mate-



RALPH JOHNSON looks over the plans, makes notes referring to standard assembly drawing in basic manual.

rials down to the last wood screw rolls off the tabulator.

To process by machine a fair sized school job may take 15 minutes; a complex industrial job maybe half an hour from take-off to completed summary. From there the printed tabulation goes back to the estimator for recap into the finished estimate.

It looks like magic, but actually the system works on well-known principles of machine data processing. The code number is an exact description of every detail of the standard operation or assembly. This information is stored in master cards which carry unit prices. The take-off card punched by the operator finds the master card or cards of the same code. Machines assemble the data, make the necessary calculations and print out the results.

Back of the process are two big loose-leaf books. The first, already mentioned, is the basic manual. It shows the standard operations and assemblies, and details the make-up of the code numbers. The second is a complete list of code numbers, some 25,000, with related unit material costs and unit labor hours.

The two books provide the most comprehensive estimating method ever attempted in the industry. They can be used for ordinary clerical processing; and for some small jobs, the estimator may price his take-off directly from the book.

The books, however, also represent the data punched into the master cards and are available for high-speed automatic machine processing.



JOB IS ASSIGNED to Estimator George A. Mills. Charts above board show standard assembly code numbers.



ESTIMATOR ENTERS quantities and code numbers on work sheet. A formula is used for branch circuit conduit and wire.



WAYNE THOMPSON in machine room checks work sheet to make sure entries are complete, notes any special instructions.



WORK SHEET is assigned to machine operator who sets up each entry on a punch card.

MASTER DATA CARDS are picked up from the central file to join the estimate cards for machine processing.



AUTOMATIC TABULATOR prints out complete estimate, priced, extended, totalled and summarized.



At first encounter, the whole process looks formidable. On critical examination, however, the standard assemblies are entirely conventional and logical. They are simply assemblies of all the electrical products and parts which normally go together for a particular outlet, fixture, device or length of feeder.

The ten digit number turns out to be equally logical and "mnemonic" (easy to remember). For example, take a run of 3 No. 6s in 1 in. EMT. The unit is 10 ft. The code is CWE306TD10 and is a very exact description.

C = conduit

W = wire

E = EMT (type of conduit)

3 = No. of wires

06 = No. 6 wire

T = TW insulation

D = installed in deck

10 = 1 in. (size of conduit)

Or an exposed duplex receptacle on Wiremold, code RED1XSSCO2.

RE = receptacle

D = Duplex

1 = 15 amp

X = Plate with receptacle

S = Specification grade

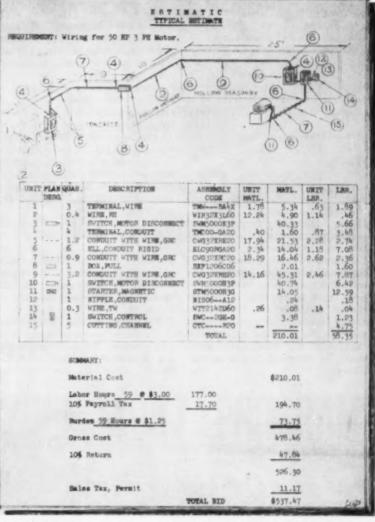
S = Surface

C = Exposed on concrete

02 = Terminal (200 Wiremold)

With practice, it is possible to memorize literally thousands of the code numbers and their meanings. However, Sturgeon estimators use four wall charts from which the exact code number of any standard assembly can be easily read.

The standard assembly-code takeoff makes possible fewer entries, to the number usually required but also imposes a rigorous discipline. The code number is actually an exact and comprehensive description. To write the code



**SAMPLE ESTIMATE** shows 15 assemblies which cover all details of installation. Actual take-off needs only quantities and code numbers. Figure work on small jobs would be clerical; large jobs would use automatic machine data processing.

ONE OF FOUR ASSEMBLY CHARTS which give the ten-digit code number for each standard assembly.

E	S			/I /		CIC	C	
NAME AND CLASS OF ASSEMBLY	123	4	5	6	7	8	9	10
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CUTTING, HOLES	CTH			068	n of o⊾€	Type or Comstruction & Majoria, Fact & Paint Company Fight		ell of
DUCT, SURFACE	DUS	-1	Monus		TYPE OF UNIT	TIPE OF CONSTRUCTION    Signature   Description   Construction   C	H. 40	Silf or Buch
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number, the estimator needs ALL of the information required. And, conversely, if he enters the full code number, he has covered every essential detail of the assembly.

A further important advantage is that the code numbers provide an exact, universal nomenclature. A take-off by one estimator can be read by another estimator, by a clerk or by the boss with equal precision.

Heading up the development of Estimatic is Ralph Edgar Johnson, professional engineer and president of the prosperous Sturgeon Electric Co. of Denver, Colo. Johnson is a keen student of modern business practices and efficiency. His operations are models of expert accountancy, able administration and good housekeeping.

Johnson recognized that in conventional estimating, much of the estimator's time must be devoted to work that is tedious, essentially clerical and routine. Since there are no standards of terminology or methods, the estimator must follow through as the work cannot practically be delegated to clerical employees.

Further, estimating is highly detailed and must encompass every item of material and labor to be precise. Yet in actual installation practice, items are used together; the conduit contains wire; the outlet box has terminals, fastenings, covers and devices.

Johnson saw an opportunity to combine items into standard assemblies which could be identified by a mnemonic code. This would 1) greatly reduce the detail work of take-off and listing, and 2) provide, in the code, a universal nomenclature and pricing method that could be competently handled by clerical employees—or by automatic data processing machines.

The great advantages of machine data processing are speed and accuracy. Once the basic data are provided and the "instructions" entered, the machine is entirely indifferent to the number or complexity of the computations required.

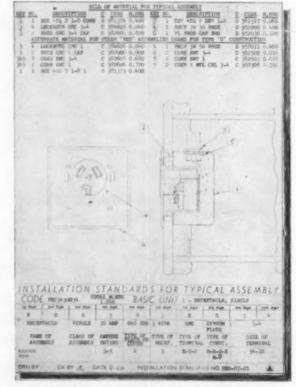
But speed, in the Estimatic operation, also poses an administrative problem. Johnson's estimators can provide only a fraction of the "load" which the machines can easily process. He is adapting machine data processing to other aspects of his business-accounting, costing, billing, etc.; but the potential "load" will still fall far short of the capabilities of the equipment.

Consequently, Johnson is inviting other electrical contractors to use Estimatic as a service. He will lease the data books and process take-offs by mail. He is also exploring the use of teletype, facsimile, and other wire services.

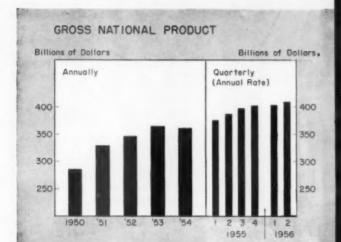
Can anyone set up the same system for his own operations? Possibly. But the initial investment is very large and the operating costs are substantial. Preparatory work in assembling data and information for machine processing involved over 10,000 engineering man-hours. Johnson expects that changes and modification requirements will take 1000 engineering man-hours annually. On top of this must be figured the cost of leasing the machines. In any event, Johnson feels that his service can be made so attractive, speedy and economical that it would not be worthwhile for other electrical contractors to attempt to duplicate the investment.

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BT3HJ31216HIRE 16AF BLK	120			
873WI31266WIRE 16AF HHI	150			
SOM 3 31 41 4 H I HE 14 RH 600 BLK	114			
392M331652MIRE 2 TH 600 BLK	1385			
63H331662HIRE 12 TH 600 HLK	195			
2985W331664WIRE 14 TH 600 PLK	9.0			
282W 331673W1RE 3-0 TH 600 BLK	3100			
13W331EZ7HIRE 350 TH 600 BLK	6224			
136W3316B0W1BE 500 TH 600 BLK	8777			
392H331702HIRE & TH 600 HHI	1205			
123433171241RE 12 TH 600 HHI	105			
2963H331714HIRE 14 TH 600 HHI	66			
352H3317G2HIRE 2 TH 600 RED	1205			
63W331772WIRE 12 TH 600 HED	125			
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NOXY 34012HIRE STEEL 12	27			
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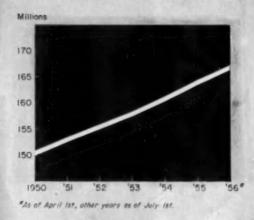
**FROM CODED ESTIMATE**, tabulator automatically prints out five copies of complete bill of materials. The CL letter at left groups items for timing release of materials to the job.



**ONE OF OVER 4**00 data sheets which describe 25,000 standard assemblies represented by code numbers.



#### U.S. POPULATION GROWTH



# Use These Facts and Trends in

## PLANNING YOUR 1957 PROGRAM

Source: Dept of Commerce

These national figures on the economy, new building and electrical construction, electric power growth, and electrical equipment sales can give you guidance in setting up your own proposed activities and work schedule for the year ahead.

By Berlon C. Cooper

TODAY'S market is highly competitive, and competition becomes keener every day. This is true in all industries. Competition is increasing not only within each industry, but also between the various industries.

First, there is direct competition. Each electrical contractor competes with other contractors for the same job. A motor repair shop competes with other repair shops in his area for the motor maintenance business. Even the consulting electrical engineer competes with other engineers for the available electrical design work.

Second, there is intraindustry competition. For example, electric heating competes with lighting fixtures. Lighting fixtures compete with electrical appliances. Electric heating cable systems compete with electric heating radiant wall panels, etc.

Finally there is interindustry competition, in which, for example, the electrical industry is competing with other industries (furniture, building materials, fabrics,

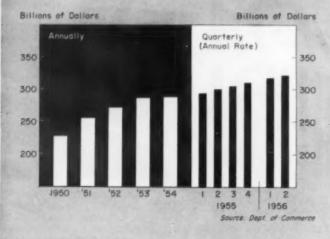
floor coverings, etc.) for the consumers dollars.

What can the individual contractor, the motor repair shop, the consulting electrical engineer, or other members of the electrical industry do about this competition? How can an individual firm not only keep and maintain its existing volume and rate of profit, but also increase and expand its total volume and profit?

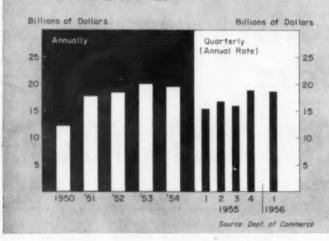
Intelligent and careful planning is needed to effectively meet this competition. Such planning should

#### General NATIONAL ECONOMY Factors (continued)

#### PERSONAL INCOME



#### PERSONAL SAVINGS

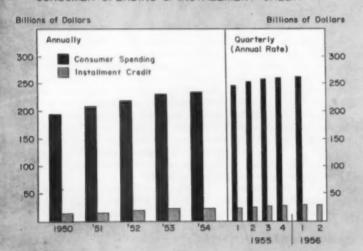


be done on both a long- and short-range basis. Long-range planning is needed for estimating the market potential and deciding what to do about it, and for setting up budgets, analyzing labor requirements, mapping out advertising and direct mail promotion, and other similar factors. Then short-range planning is needed for effective timing of the various program activities, for purchasing, scheduling, etc., all based on a day-to-day analysis of the business outlook, both national and local.

For long-range planning, national statistics on both the national economy and those factors which have a direct effect on the market for electrical goods and services offer excellent guide lines. These national figures should, of course, be considered only as they apply to a particular business, and modified in the light of local area conditions. Such national statistics. considered pertinent to long-range planning by members of the electrical industry, are presented here. These statistics are published now, rather than at year's end, so that plans for next year's activities may be completed promptly and be ready for launching in January.

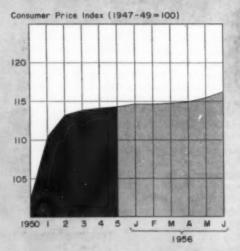
In general, charts and tables shown here give annual figures for the years 1950 through 1955, and quarterly figures for 1955 and first half of 1956. The annual figures indicate general trends, while the quarterly figures give a more detailed analysis of the trends over the past 18 months.

#### CONSUMER SPENDING & INSTALLMENT CREDIT



Source Dept of Commerce

#### COST OF LIVING



Source: Dept. of Commerce

#### National Economy

The outlook for 1957, overall, is for the best year ever. In fact, the upturn in business is already getting under way. Industrial output, which has declined slightly during 1956, is now climbing again as steel mills begin turning out more steel than ever, and auto production goes into high gear on new models. Pick-up in industrial production for the remainder of this year is expected to bring the year's total to about 2% more than 1955, making 1956 also a record year.

Gross national product (see chart), a measure of the nation's output of goods and services, has climbed from \$285 billion in 1950 to an annual rate of \$408.5 billion during the second half of 1956, measured in current dollars, with only one downturn in 1954. Over the past year, and measured in constant prices, it has been almost steady, with an increase of about 1%. During the first half of 1956 the cutput of services has increased sufficiently to offset the decline in production. The business climate is now such as to point to an upturn and an increase of some \$20 billion, or about 5%, by the end of 1957.

A constantly increasing population is a basic element in our economic growth. Population increase since 1950 (see chart) is about 18 million, or 12% in six years, That's the national average. Local communities should be analyzed for variations.

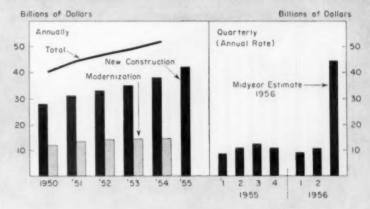
Cost of living has increased about 14% since 1950, or from 102.4 to 116.2 as measured by the Consumer Price Index—1947-49 prices used as a base of 100 (see chart). Cost of living has been relatively stable since 1952, when the index was 113.2, but is expected to inch up gradually in the months ahead, at a rate of about 1% a year as wages increase at a faster rate than productivity.

#### **Building Construction**

Building construction currently accounts for nearly 11% of the national economy—\$44.5 billion annual rate in a \$408.5 billion GNP annual rate for the second quarter. In every post-War II year building construction dollar volume has increased over the previous year's expenditures, including 1954 (see

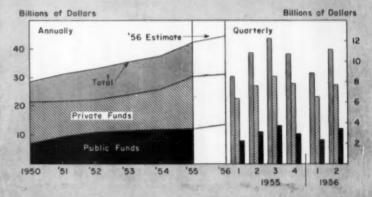
#### Trends in NEW BUILDING CONSTRUCTION

#### NEW BUILDING CONSTRUCTION AND MODERNIZATION



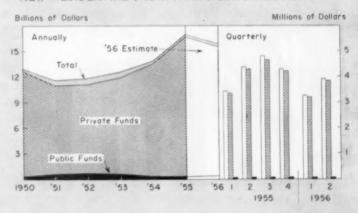
Source: Commerce & Lober Depts

#### NEW CONSTRUCTION EXPENDITURES

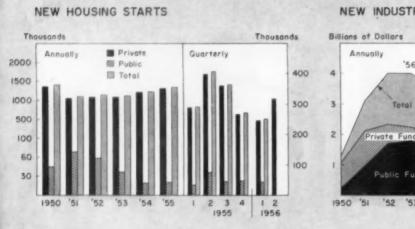


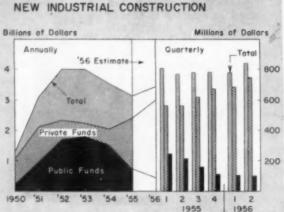
Source: Commerce & Labor Depts.

#### NEW RESIDENTIAL (NON-FARM) CONSTRUCTION

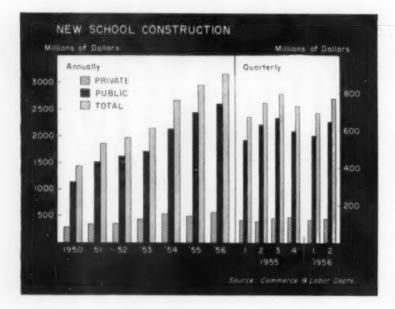


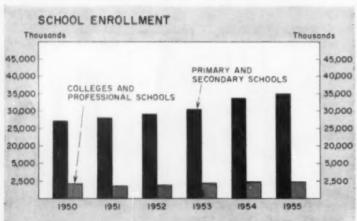
#### Trends in New Building Construction (continued)





Source: Commerce & Labor Depts.





Source: Dept. of Commerce

chart) when GNP showed a small decline and the nation experienced a so-called "recession". Thus building construction work has truly been an economic stabilizing factor for the past decade. Similarly, it has provided a continuously expanding market for the electrical construction industry.

While no detailed building construction forecasts for 1957 have yet been released, there is every indication that expenditures next year will exceed those for 1956. Analysis of trends for specific types of construction, and programs already approved or under consideration, point to an increase in construction dollar volume in 1957 of some \$2.5 to \$3.0 billion. or a total of \$47 billion or more next year. Utilities, private industrial buildings, and highways will account for the major gains. The accompanying charts show volume trends on specific types of new building construction.

The chart on "New Construction Expenditures" shows the relation between private and public spending from 1950 to mid-1956. Private expenditures have ranged generally from two-thirds to three-fourths of the total, with estimate for 1956 total at about 70%. The new highway building program now under way, plus the steppedup public housing spending already authorized by Congress will probably reduce the private expenditure percentage of the total.

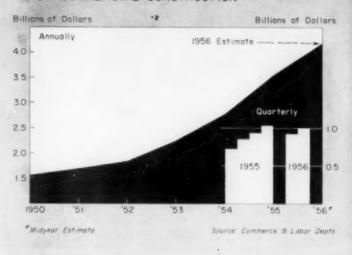
New housing construction has been a matter of considerable concern for the past several monthsto government officials concerned with the stability of the economy, to builders, to building materials producers and suppliers, and to manufacturers, wholesalers and retailers of home furnishings and appliances. Yet the decline in dollar volume (see chart) this year from last year's record \$16,861 million will probably be less than 9%, to a total volume of about \$15.5 billion. This will still be the second highest dollar volume on record. When analyzed on the basis of housing units started (see chart), it is estimated 1956 starts will total about 1.1 million, compared with 1955's 1,328 thousand starts, or the record 1,396 thousand starts of 1950. This reflects the rise in construction costs which has occurred. and a continuing trend toward larger homes with more quality features.

New homebuilding is expected to level out this fall at an annual rate of about 1.1 million units, and to increase slightly during 1957 to about 1.25 million. Dollar volume next year will probably equal or exceed the 1955 record.

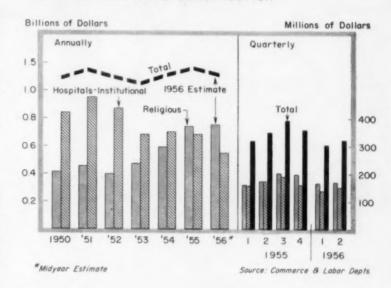
#### Industrial Activity

Industrial construction rose from \$1,286 million in 1950 to \$4 billion in 1952 and 1953, then declined to \$3,123 million in 1955 (see chart). Estimate for 1956 is \$3,425 million. These figures include both private and public spending. Private ex-

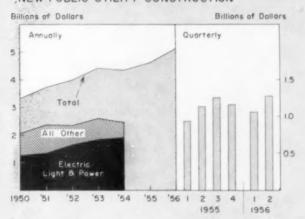
#### NEW COMMERCIAL CONSTRUCTION



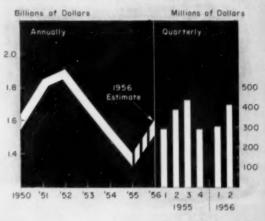
#### NEW INSTITUTIONAL CONSTRUCTION



#### NEW PUBLIC UTILITY CONSTRUCTION

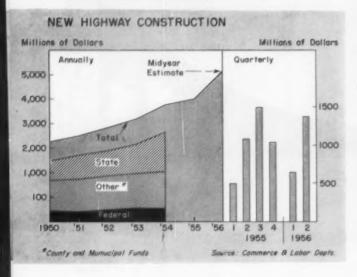


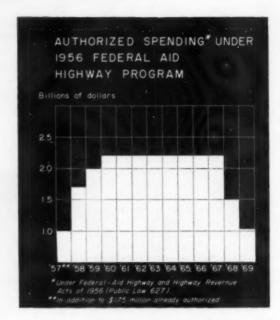
#### NEW FARM CONSTRUCTION



Source Commerce & Labor Depts

#### Trends in New Building Construction (continued)





penditures in 1951 more than doubled the 1950 total, then held steady until last year, when they rose about 20%. Estimate for 1956 is \$3 billion, reflecting a strong uptrend currently in capital outlays for new plant and equipment by American industry. This trend is expected to hold through 1957, at least. Public expenditures for industrial construction catapulted to a high of \$1,771 million in 1953, as an outgrowth of the Atomic Energy program and the Korean war, is now down to less than onefourth the 1953 rate.

School construction has climbed

steadily over the past six-year period (see chart), slightly more than doubling during this time. Last year the U.S. Office of Education stated its needs for school construction was \$41.5 billion through 1965 (EC&M, October 1955, p. 100). Classrooms available last year were 1,045,000, which was totally inadequate, according to an Engineering News-Record survey. Trends in school enrollment (see chart) show an additional one million or more students annually. The school construction program must provide classrooms for the annual student increase, plus re-

placement of existing classrooms as required by obsolescence. Construction of public schools will probably advance to an alltime high in 1957.

Construction of commercial buildings, such as offices, stores, restaurants, warehouses, garages, social and recreational building, etc. has more than doubled since 1950 (see chart), and is continuing at an even stronger pace. Religious, hospital and other institutional building has remained firm since 1950 (see chart), is currently strong in the new church construction field.

Highway construction. under the biggest public works program in history, will create an impact far beyond the field of heavy construction. This is a 13year, multibillion dollar undertaking, authorized by the Federal-Aid Highway and Highway Revenue Acts of 1956. Under this Act a total of \$37.6 billion are authorized to match an equal amount by States, to provide a limited-access, 40,000-mile superhighway network. Included is a greatly expanded market for lighting and electrical work, but one which must be actively promoted to be sold.

Aside from the new construction work already completed and now under way, *Engineering News-Record* in July reported the new construction and building backlog (see chart) crossed the \$100-billion mark for the first time in history.

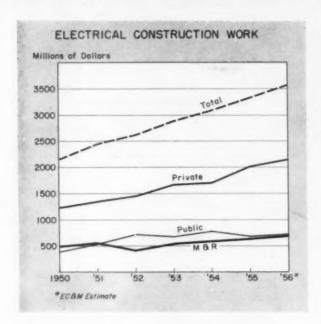
#### **ELECTRICAL APPLIANCES (SIC CODE 3621)**

(Thousands of Dollars)

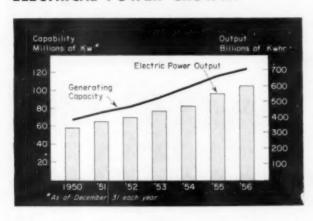
	V	slue
Item	1947	1954
Total industry	550,234	803,366
Electric fans (except industrial)	48,656	88,355
Household water heaters	59,362	48,598
Small household electric appliances	249,169	370,455
Household ranges	132,235	162,994
Commercial cooking equipment	13,478	20,736
Parts and Accessories	40,729	109,001
Electrical appliances, n.e.c.	6,605	3,227

Source: Census Bureau's "Census of Manufactures"

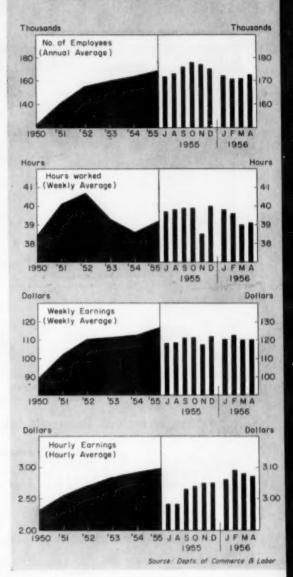
#### **NEW ELECTRICAL CONSTRUCTION WORK**



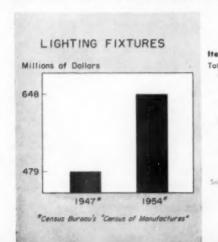
#### **ELECTRICAL POWER GROWTH**



#### ELECTRICAL WORKERS IN BUILDING CONSTRUCTION



#### **ELECTRICAL EQUIPMENT SALES**



#### **ELECTRIC LAMPS (SIC CODE 3651)**

	41110000000					
em	1950	1951	1952	1953	1954	1955
otal industry, all types	233,860	252,465	229,899	277,529	290,619	323,172
Large incandescent	127,795	115,613	107,324	122,349	132,937	137,031
General lighting, above 150w.	15,466	16,691	15,217	16,887	17,330	16,401
General lighting, 150w. and						
below	53,930	54,187	50,495	58,597	65,350	67,067
Reflector lamps	4,464	6,591	9,045	10,317	11,446	12,315
Electrical discharge	60,202	63,787	57,098	68,824	72,696	78,923
Sun lamps	1,753	1,424	1,788	1,938	1,604	1,901
Fluorescent hat cathode	53,168	54,194	47,073	58,138	62,032	66,969
Miscellaneous electric discharge	4,659	7,195	7,347	7,763	8,210	9,115
Mercury		3,311	3,857	3,980	4,169	4,805
Sodium			2,241	2,180	2,663	2,591

Source Census Bureau and Dept. of Commerce

#### ELECTRICAL EQUIPMENT SALES

(continued)

#### ELECTRICAL INDUSTRIAL APPARATUS

#### Wiring Devices and Supplies (SIC Code 3611)

(Thousands of Dollars)

	Val	ue ue
Items	1947	1954
Total industry	375,653	569,369
Current-carrying wiring devices	167,266	287,457
Non-current-carrying wiring devices and supplies	147,680	208,849
Pole line and transmission hardware	57,207	70,914
Wiring devices and supplies, e.e.c.	3.000	2,140

#### **Electrical Measuring Instruments (SIC Code 3613)**

(Thousands of Dollars

	Value		
Items	1947	1954	
Total Industry	157,453	345,389	
Integrating instruments	63,650	73,090	
Test equipment	54,805	188,115	
Other eleterical measuring intervments	38,998	84,184	

Transformers (SIC Code 3615)

(Thousands of Dollars)

	Velue		
Items	1947	1954	
Total industry	326,777	626,809	
Specialty transformers	80,672	109,554	
Luminous tube transformers	10,742	6,432	
Fluorescent lamp ballasts	35,158	48,213	
Lighting transformers	NA	10,281	
Power and distribution transformers	107,886	135,559	
Power regulators, boosters, reactors, etc.	40,162	76,167	

#### Electrical Control Apparatus (SIC Code 3616)

(Thousands of Dollars)

	Value			
Items	1947	1954		
Total industry	558,483	1,056,184		
Switchgoor and switchboard apparatus	336,553	695,598		
Switches (Knife, time, other)	71,254	70,094		
Circuit breakers	73,303	157,425		
Power switchboards	91,018	181,840		
industrial eleterical control equipment	171,232	333,794		
Fuses and fuse equipment	20,698	26,792		

#### Electrical Welding Apparatus (SIC Code 3617)

(Thousands of Dallars)

	Vol	lue
Itoms	1947	1954
Total industry	107,616	160,033
Arc welding machines, components, etc.	32,110	36,490
Arc welding electrodes, metal	43,987	72,265
Resistance welders, parts, etc.	29,874	51,078
Electrical welding apparatus, n.e.c.	1.645	

Source Census Bureau s Census of Manufactures

#### BACKLOG OF PROPOSED ENGINEERING CONSTRUCTION

(as of July 31, 1956)

#### **PUBLIC WORKS PROJECTS**

(Thousands of Dollars)

Type Work	Backing
Waterwarks	2,066,159
Sewerage	3,091,064
Bridges	2,884,115
Earthwork, Irrigation	11,247,491
Street and roads	11,625,562
Buildings	17,901,159
Unclassified	8,578,580
Total	57,394,130
Federal Government Work	12,815,430
PRIVATE PROJECTS	
Bridges	89,711
Industrial Buildings	15,853,938
Commercial Buildings	17,618,438
Unclassified	9,411,220
Total	42,973,307
CONSTRUCTION	
Public Works Projects (Total)	57,394,130
Private Projects (Total)	42,973,307
Total (Sub-Total)	100,367,437

#### CONSTRUCTION VOLUME PROJECTED\* TO 1965

(Milliam of Dollars)

Type	1965 Volume
Heavy construction	
ENR Contracts	
Building	21,000
All	33,000
All Construction Put-in-Place	
Estimated total	
Building	39,000
All	59,000
Maintenance and Repair	21,000
Characters by Conjunction News Perced	

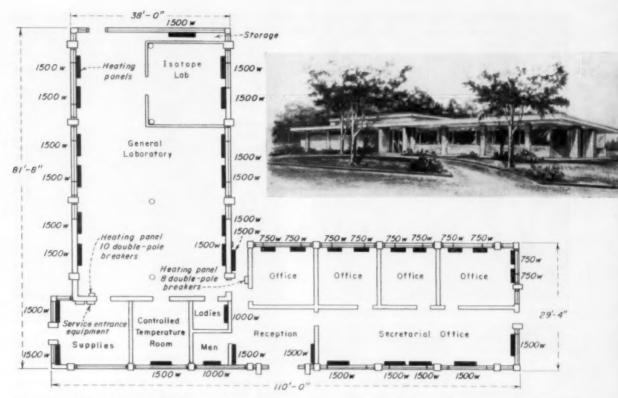
#### **Electrical Construction Work**

Electrical construction work in new building construction and modernization projects is increasing at an approximate average of 10% per year (see chart), somewhat faster than the rate of growth of new building construction. This reflects an additional growth in the use of electrical utilization devices and the resultant need for additional wiring.

There are now about 172,500 electrical workers employed, working an average of 39.1 hours weekly, earning an average of about \$120 a week (see chart). Hourly rates for electrical workers have increased from \$2.32 in 1952 to \$3.07 in April of this year.

Growth of the electric power industry is reflected in generating capacity and electric power output (see charts). By the end of this year, capacity will have more than doubled during the past six years. Output will have increased by about 80% over the same period.

Reports on electrical equipment sales are currently being released by U. S. Census Bureau, some are covered in accompanying charts.



**HEATING PLANS** for research laboratory and offices, changed from oil system to electricity during construction, provided 23 1500-watt, ten 750-watt, and two 1000-watt heaters. Total connected load is 44 kw. Heated area measures 5175 sq ft, heated volume 15,000 cu ft. Office ceiling height is 8 ft, laboratory 12 ft. Note absence of smokestack.

## Heating for Research . . . with Electricity

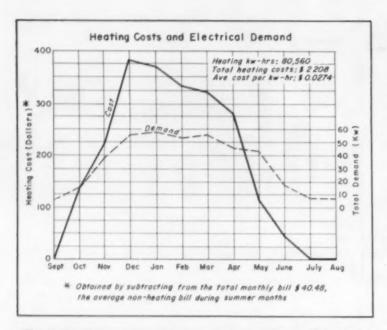
Radiant glass wall panels provide winter heating comfort for laboratories and offices of York Research Corp., Stamford, Conn.

LAST-MINUTE decision halfthrough construction adopted electric heat for the new laboratory and office building of the York Research Corp., Stamford, Conn. Sold on the prospects eliminating the previously planned oil-fired burner and associated equipment, the firm's management had the necessary electrical branch circuits added to the plan. Although additional thermal insulation and double-glass windows throughout were suggested and deliberated, it was decided to go along with the original plan in those respects.

The Stamford Electrical Contracting Co. installed heater circuits in rigid conduit beneath the floor slab of the one-story building from two circuit breaker panels. One in the laboratory contains ten circuits to the laboratory, supply room, controlled temperature room and washroom heaters; the other off the reception hall supplies eight circuits to the office areas.

All offices and partitioned rooms have individual thermostat control; the general laboratory has a thermostat for each of its six bays, including the isotope lab. This feature provided a noticeable advantage during the first winter's operation. Absent were the usual employee complaints due to differences of opinion as to the suitability of the temperature. The workers in each bay were permitted to control their own thermostats, the resulting selected settings ranging from 72 to 85F

Originally, the design called for 4500 watts less of installed capacity based on the 240-volt rating of the heaters supplied. However, electrical service turned out to be 120/208 volts, not 240, resulting in a 15% loss in heating output. The Glassheat panels containing the



Suggested Improvement	Heat Loss (watts)		Savings		
	As Is	Improved	Watts	Annual Kw-hrs	Annual
Ceiling Increase insulation from 3 in, to 6 in.	5690	4100	1590	2530	\$ 69
Laboratory walls  Add 3 in. insulation, 2 x 4 furring and gypsum board	14,750	5570	9180	14,600	\$400
Office walls  Replace single glass of windows with double glass	19,700	10,000	9700	15,400	\$422
Totals	40,140	19,670	20,470	32,530	\$891

heating elements were exchanged for similar panels rated at 208 volts, and three more 1500-watt units were installed on the right-hand wall of the laboratory to make up for the deficiency.

The accompanying chart gives the first winter's heating costs. Although the \$.0274 per kw-hr average rate is extremely high for electric heating, the management has hopes of a review and readjustment of rates and demand charges by the utility in the future as diversity and demand data on the installation are obtained.

York executives are extremely well pleased with the heat. They cite several benefits which offset the high heating costs: (1) A special industrial insurance policy with an annual premium of \$200 which would have been mandatory using a fuel-burning system is now unnecessary, (2) The originally proposed oil-fired furnace would have required a service and maintenance contract costing an additional \$250 per year. As yet, no maintenance, repair or replacement has been required for the electric heaters, (3) Elimination of the chimney from the plans saved \$700 in construction costs. (4) The room initially planned for the furnace, oil tank, etc., has provided an additional 240 sq ft of floor space currently being used for supplies and as a display area. This room can be converted into an office with little modification. (5) The complete absence of soot and dirt accumulation normally associated with a fuelburning system has contributed materially to working conditions, cleanliness being a big factor in the laboratory's precision testing of products and materials.

Of inestimable value was the performance of the system during the unprecedented Connecticut floods in the fall of 1955. For a period of 20 hours the heaters were anywhere from 1 to 4 ft under water. The next day the lab was drained and the heaters turned on as cleanup operations began. All worked perfectly; there were no cracked panels, there was nothing to replace. They aided materially in drying the walls, floors and equipment.

#### Insulation

The building's thermal insulation is admittedly inadequate, stemming from the fact that it had been designed for a conventional fuel-burning plant. It is interesting to examine the construction from this standpoint to determine what prospective savings are indicated should additional insulation be installed in the future.

The 5-ply tar, pitch and pebble bonded roof deck on 1-in. insulating board and 3-in. wood sheathing is supported by 2 by 12 joists, includes 3-in, mineral wool blankets between joists and is finished on the interior with 1-in. gypsum board. The overall heat-loss coefficient of this roof is .016 watt/sq ft/deg F, which meets the insulation recommendations recently published by the National Electric Manufacturers Association for electric heating. This results in a total ceiling heat loss of 5690 watts. Increasing the insulation to 6 in. of loose fill mineral wool would lower the heat loss factor to .011 watt/sq ft/deg F, reducing heat loss to 4100 watts as shown in the accompanying table.

A bigger opportunity for reduction of heat loss lies in the walls of the laboratory. At present they are 8-in. cinder blocks with no interior or exterior finish other than paint, double-glass windows occupying the upper 2 ft of the wall area. This represents a combined heat loss coefficient of .127 watt/sq ft/deg F, far exceeding NEMA recommendations for maximum loss, and a total heat loss for lab walls of 14,750 watts.

The maximum practical insulation which could be added would be 3-in. blankets with 2 by 4 furring,



**BREAKER PANEL** at left serves laboratory heating circuits. Center panel feeds lighting; at right is main power panel.



LAB HEATERS are surface-mounted on walls above work areas. Thermostats in each bay are controlled by the employes,

plus gypsum board or other suitable interior finish. Such an arrangement would, with the double-glass windows, reduce the overall heat loss factor to .048 watt and the total heat loss of the walls to 5.570 watts.

The frame walls of the offices and reception area are faced with a course of brick veneer over plywood sheathing, contain 3-in. mineral wool blankets, and are finished on the interior with 1-in. gypsum board. However, single-glass windows occupy over two-thirds of the entire wall area, resulting in an overall heat loss factor of .214 watt/sq ft/deg F and a total loss of 19,700 watts. The only practical improvement lies in replacing the windows with double glass. This would lower the factor to .109 watt and the loss to 10,000 watts.

The outside walls of the supply room, controlled temperature room and washroom are of the same construction as the office walls; however the 2-ft windows at the top of the wall are of double glass. Combined heat loss factor for the walls is .059 watt/sq ft/deg F. No improvement in insulation can be effected; however this factor of .059 as compared with the .214 of the offices shows the great effect of the large glass areas on the heat loss. Almost four times as much heat is lost through the office walls as through those of the supply room, etc.

The accompanying table sum-

marizes these observations on prospective savings through insulation, based on the average rate paid for electricity during the first heating season. The 20,470 watts heat loss saved is particularly significant because of its effect on initial cost, since actual installed capacity was only 44,000 watts. This means that, assuming the heaters installed were sufficient for existing conditions, almost half the initial cost of equipment and installation could have been avoided with the

additional insulation.

Thus as a yardstick for planning similar electric heating projects for future construction (or a future addition to this existing building), these figures speak for themselves. As a basis for making changes to the existing structure, however, the indicated savings must be weighed against the materials and labor costs of making the changes, the amortization period, and the effect of further construction on normal work progress.



BASEBOARD HEATERS in all private offices are rated at 750 watts, two heaters per office.

## MULTIPLE SYSTEMS SERVE PLANT

New \$4½-million industrial plant in Cleveland uses ac voltage going from 220 to 4800, dc voltage ranging from 15 to 600, frequencies from 20 to 120 cycles and distribution mediums including hinged wireways and interlocked armor, plug-in and underfloor ducts, special test switchboards and panels, capacitors and safety devices.

LECTRICAL and architectural interest is being directed toward a modern industrial plant recently completed in southeastern Cleveland. Equipped with an electrical system that provides a range of ac from 220 to 4800 volts, a range of dc from 15 to 600 volts, and a frequency selection between 20 and 120 cycles, this structure commendably satisfies demands of production, development, laboratory research work and testing. Also, due to a large manufacturing floor area (measuring 550 by 450 ft), wide column spacing (50 ft apart) and high trusses (permitting 22 ft clearances beneath crane hooks), great flexibility of production layout and operation is obtained. Located on a 27-acre landscaped plot, this trim-looking brick-and-aluminum building provides a total of 340,000 sq ft of floor space, replaces half a dozen formerly occupied industrial structures, employs better than 600 people, and represents an investment of \$41-million on the part of the Electric Controller and Manufacturing Division of Square D Mfg. Co.

To operate dc motors in shop areas, to permit testing of equipment, to provide a wide range of current characteristics for laboratory work and to serve equipment in the company's display room, numerous special m-g and transformer combinations are installed. such as two 100-kw 460/230-volt dry-type transformers wired in open delta to supply 230-volt 3-phase current; a 100-kw 230-volt dc generator coupled to a 440-volt 3-phase motor; a 62.5-kva variablefrequency generator set with a 230volt dc motor drive (mounted on vibration pads) a 25000-amp test transformer (segregated by a wire cage), and a 15-volt 1500-amp generator driven by a 440-volt motor. These same areas are also served by 4160-volt and 480-volt 3-phase ac. obtained through electrically operated breakers, located at one of two main substations. This equipment (backed by special test switchboards; panels for testing, control and switching; 225-amp de plug-in duct and 2-compartment continuously hinged wireways) offers an unusually wide variety of voltages and frequencies.

Wiring of all related circuits is color-coded for accurate identification. Polarized plug-in devices are used to prevent inadvertent misconnections. Switches and outlets are marked for positive information purposes. Test areas and high-voltage equipments are made inaccessible to unauthorized persons by wire mesh enclosures, balcony or mezzanine isolation, or by other equally-effective means for obtaining protection or security of personnel or equipment.

Included as an item for hoistcontrol research is a 55-ft-high tower with facilities for thoroughly investigating both ac and dc hoist circuit problems. The plant is also served by such electrically powered items as floor-controlled cranes for materials handling, extensive air conditioning and blower equipment to maintain comfortable working temperatures, a 2-stage exhaust system for additional atmospheric comfort and purity, motorized doors and heaters at air-locked loading docks, adjustable 10-ton loading ramps to bring truck tailgates level with shipping platforms, plus the usual array of motors for operating pumps, dampers, production machinery and the like.

#### Six-fold Distribution

Secondary distribution through the plant and adjoining office structure is essentially via 480-volt 400-amp ac copper-bus plug-in duct, augmented by several types of continuously accessible wireways, dc plug-in duct, underfloor steel duct, plus interlocked-armor (carrying VC insulated cables) and rigid conduit (with either RH, RR or V cable) connections extending between substations and busduct arteries.

In general, both feeders and busducts in manufacturing and assembly areas are installed above lower members of roof trusses, thereby providing maximum clearance distances for cranes and conveyors; conduits are supported by channels and clamps, while interlocked armor is supported by cable ladders. Cable feed boxes on duct runs are liberally dimensioned to prevent cramping of connections, while plug-in switch units (for motors, lighting transformers and other purposes) are quick-make-break fusible-switch types.

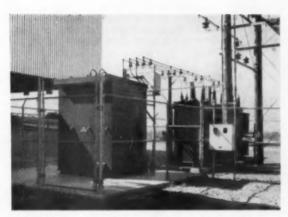
In the interest of personnel safety, busduct voltage (480) is plainly stenciled on both sides of all ducts at maximum intervals of 40 ft to remind maintenance men that discretion is recommended, and all plug-in devices are interlocked with respective covers so that bus contacts are automatically interrupted whenever device doors are opened.

All distribution panels (both for 480-volt power and 120/208-volt

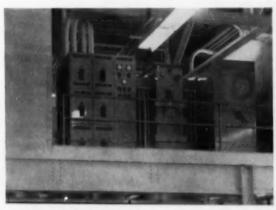
# POWER NEEDS



**LIGHTING INSTALLATION** receives deserved emphasis in this twilight photograph of EC&M's modern 8-acre office-factory structure on outskirts of Cleveland. Lighting plan combines fluorescent, incandescent and mercury sources with wide range of fixtures and installational variations.



**OUTDOOR SUBSTATION** consists of three 667-kva delta-wye 33/4.16-kv transformers, overhead 4160-volt bus structure terminating at metering transformer cabinet, and circuit breaker cubicle (left foreground) having access door plus removable front wall to facilitate free movement of draw-out breaker units. Mounting pads are trowel-finished concrete, pierced beneath the breaker cubicle by 4-in. ducts that carry twin 3/c 4/0 5-kv feeders underground and into plant to serve two interior substations.



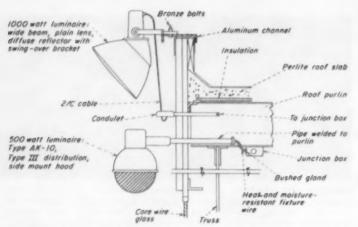
PRIMARY SELECTIVE RADIAL distribution system includes two balcony-based load-center substations, one rated at a thousand kva and the other (above) consisting of a 3-position oil switch (for Feeders 1 and 2 plus Off), a 750-kva 4160/480-volt transformer and six totally enclosed 600-amp feeder breakers related to plant-wide busduct distribution system. Also included in this substation is a 300-kva transformer with related switchgear for 120/208-volt power. Primary power ascends from manhole through 4-in. ducts.



HIGH BAY AREA where electric lifting magnets are produced has floor-to-crane-hook clearance of 22 ft. Illumination is provided by 400-watt color-corrected mercury lamps mounted above lower chords of roof trusses, and both oc and dc power is carried along column lines through plug-in busducts.



FACTORY SECTION is illuminated by Day-Brite CFI-10s (Comfort for Industry, with a 10% upward lighting component). Result is minimized brightness ratios between fixtures and ceiling, providing greater visual comfort and reducing eye fatigue of workers.

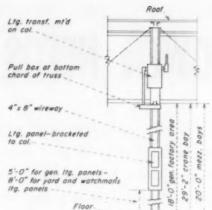


EXTERIOR LIGHTING is provided by several types of fixtures, two of which are shown here in a composite drawing. Wide-beam floodlight is mounted atop roof parapet, while Type AK-10 is supported by conduit that pierces wall at purlin level and is welded to same. Connection of both types of units to junction box is via heat- and moisture-resistant fixture wire.

Ducts for the underground system are 4-in. concrete-sheathed, duct joints being of the Harrington tapered type with waterproof seals, and twin feeders (mutually serving two interior load-center substations) each consisting of one 4/0 3/c 5-kv varnished-cambric lead-covered cable, plus a 1/0 singleconductor 600-volt type RR neutral. Where cables are exposed in manholes they are wrapped with multiple layers of asbestos tape, then sealed in place by sodium-silicate impregnations.

These underground feeders rise and terminate (through primary

MOTOR OPERATED POSITIONER holds outer pole shoe and magnet case firmly together while bond is established by means of an automatic continuous weld. Machine is powered through cable-conduit connection to plug-in busduct mounted in adjacent bay at truss level.



LIGHTING PANELS in factory areas bracketed to structural columns, with wireways extending upward along column webs to pull boxes located just below roof trusses. Transformers are served from busduct system.

into 480-volt busducts. Primary and Secondary Subs

lighting purposes) are circuit

breaker types, enclosed in wall-

mounted cabinets with adequate wiring gutters. Lighting distri-

bution panels are also equipped with

solid neutral terminals, as are light-

ing panelboards throughout the plant. In factory areas, panels con-

trolling branch circuits for light-

ing are mounted on free-standing

columns, with 4-by-6-in. wireways

extending upwards along column webs to pull boxes and terminal

cabinets located at roof truss level.

Panels related to exterior and

watchman lighting circuits are

equipped with mechanically latched

magnetic switches, and all 120/208-

volt lighting panels are served by

single-phase transformers plugged

Primary electrical service is supplied through an outdoor fenceenclosed pad-mounted utility substation where 33-kv incoming power is stepped to 4160 volts for underground distribution into the plant. Actual transition to underground entrances are via twin porcelain-enclosed 400-amp disconnects; connections between disconnects, utility 4160-volt wye bus structure and underground cable potheads being established through fully insulated Neoprene-jacketed corona-resisting synthetic rubber cables. Plant power factor averages 98.7%, a single 90-kvar bank of capacitors being installed on the secondary side of the main outdoor substation to achieve this level.

load-break switches and gang-operated 3-pole oil fuse cutouts) at the two main mezzanine-based ac load-center subs, one station consisting of a 1000-kva 480-volt transformer with related switchgear. The other includes a 750-kva 480volt assembly, a 300-kva 120/208volt equipment grouping, plus separate breaker-protected feeders extending to a 4160-volt m-g set and to a high-voltage laboratory switching center.

At both substations, transformers are non-flammable liquid-cooled units; load-break switches are 3position (for feeders 1 and 2 plus Off), and low-voltage feeder breakers are draw-out air units. All interconnections between primary potheads, load-break switches, cutouts, transformers and secondary feeders (including armored cable and rigid conduits) are fully metalclad, with access panels to facilitate connecting and servicing.

Also included with each switching group are meters and instruments for recording current and voltages for each phase of each 480volt secondary feeder. All circuit breakers are door-interlocked so that units can be withdrawn only when breakers are in their opened positions.

#### Light Levels Go To 75 fc

The lighting system in the plant combines fluorescent, incandescent and color-corrected mercury-vapor lamps, with offices and drafting rooms receiving up to 75 footcandles of illumination on desk-tops

and production areas receiving 35 fc or better in all sections.

Fixtures in factory sections are 3-lamp industrial types, with a10% upward component of light relieving under-roof brightness ratios, and with 8-ft T-12 standard warm white lamps operating at 430 milliamps. Slots in reflectors (permitting upward emission of light) promote updraft ventilation, thereby minimizing dust collection, maintaining higher resultant light output for longer intervals between cleaning cycles, and promoting cooler (and more efficient) operation of lamps. Fixtures are generally mounted end-to-end in continuous runs spaced 18 ft apart, with hanger rods secured directly to roof purlins.

High-bay sections of the factory are lighted by 400-watt mercury lamps in wide-spread Alzak aluminum reflectors. Mounted 18 feet apart in both directions, reflectors are located 2 ft above lower members of roof trusses; i.e., 30 ft above floor level. Reflectors are ventilated removable units equipped with shock-absorbing sockets, and ballasts are positioned adjacent to fixture-hanging condulets.

Fixtures in drafting, engineering and office sections are predominantly 2- or 4-lamp 40-watt luminaires with rapid-start lamps, variously recessed, surface-or stemmounted, with either aluminum parabolic louvers, lenses or frosted glass panels installed for shielding or diffusion of light.

Exterior lighting is provided primarily by 1000-watt wide-beam plain-lens diffuse-reflector units, or by 500-watt Type II side-mount noods with enclosing globes, both units being atop or just below roof parapets.

To ease materials handling and permit maximum use of fork lift trucks, main aisles are 10 ft in width. Also, to facilitate plantwide distribution of materials, all tramrall systems are linked through interlocked transfer sections, and hooks of adjacent cranes can be easily shifted so that, when necessary or desirable, two hooks can be operated conjunctionally.

Responsible for the creation of this modern structure are Arthur E. Rowe and Associates, architects; P. C. Mehnert and Charles K. Reid, consulting electrical engineers; and the Herbst Electric Company, electrical contractors, all from Cleveland.



**FLUSH-MOUNTED TROFFERS** in ceiling of drafting room are Day-Brite aluminum paralouver units, providing 75 footcandles of evenly diffused illumination to working surfaces.



**CONTINUOUS RUNS** of Luvex fixtures in office sections provide uniform, even, shadowless, general illumination. Distribution of wiring serving office appliances (such as dictaphones, tabulators, etc.) and telephone system is via double-cell steel underfloor ducts.



**ENTRANCE LOBBY** combines pattern of lensed incandescent down-lighting for casual reading, auxiliary functional lighting over stairway and receptionist's desk, air conditioning, paging system and telephone facilities for convenience of visitors to plant.

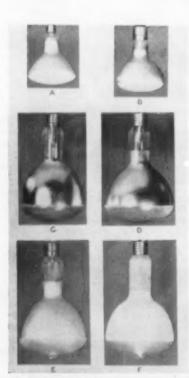


# DIRT— Thief of Light

Reflector lamps solve many industrial lighting problems and help to reduce lighting maintenance costs.

By James D. Hall,

Lamp Division
Westinghouse Electric Corporation
Bloomfield, N. J.



REFLECTOR LAMPS eliminate need for cleaning of luminaires (none used), and are suitable for many industrial lighting applications. Typical R-lamps shown above are: A—R40 flood and spot, 150 and 300 watt; B—R40 flood and spot, 300 and 500 watt; C—R52 wide beam, 550 and 800 watt; D—R57 narrow and medium beam, 550, 800 and 1000 watt (Types A, B, C & D all 2000 hrs life); E—R57 medium and wide beam mercury, 400 watt; and F—R57 semi-reflector fluorescent-mercury, 400 watt (Types E and F 7000 hrs life).

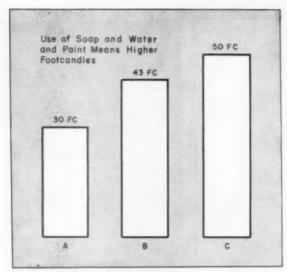
T WOULD be difficult, if not impossible, to find an engineer, a maintenance man, or anyone else responsible for a lighting system who does not know and appreciate the value of good lighting. And "good lighting" means "good maintenance". Yet, because of pressure to reduce expenses, some have occasionally economized on cost of labor for lamp and fixture cleaning. In consequence, the amount of attention given to the maintenance of a lighting system is often in inverse ratio to labor costs-as labor costs rise, down go the man-hours spent in keeping lighting equipment clean. Although this is false economy, the practice seems to be on the increase. The result is that in many installations the light intensity has sunk to an uneconomical and sometimes dangerous level. In some industrial plants, the lighting equipment and lamps have become so blackened from the accumulation of soot and dirt that the light produced appears to be hardly more than that needed for locating the fixtures.

Obviously, the most serious luminaire maintenance problems occur under conditions where lighting equipment is inaccessible and where the air is laden with smoke and dirt. In such places, the cost of maintenance really becomes burdensome. The burden is still heavier when corrosive fumes in the air attack and destroy lighting equipment long before the end of its normal life. Under such conditions,

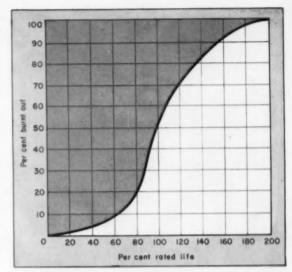
and where it is not practical to provide proper maintenance, the ideal solution is the use of equipment that does not require cleaning and that is not susceptible to the corrosive effects of chemical fumes. Although this sounds impossible, it is really quite practical. The tailormade answer lies in lamps that need no external reflectors-lamps that incorporate a hermetically sealed-in reflector coating applied to the inner surface of the bulb. This reflector is unaffected by an accumulation of dirt on the outer surface. Too, glass is impervious to most chemical corrosive action; consequently, reflector-type lamps are immune to deterioration caused by most industrial plant atmos-

Replacement of a burnt-out reflector-type lamp, in effect, is equivalent to the installation of a brand-new, clean fixture—a perfect, simple and inexpensive way to maintain footcandle levels. Thus when reflector-type lamps are used, the labor cost of maintenance consists only of that for replacing burnt-out lamps. The reflector-type lamp and a group-replacement program provide an unbeatable answer to the problem of good lighting where maintenance is difficult.

Group replacement long has been the popular method of relamping street-lighting and railway-signal systems. As labor costs have risen, it has become increasingly popular for application to systems used for



**KEEPING LUMINAIRES CLEAN** results in better lighting. In a typical installation, A shows illumination before cleaning. B shows lighting intensity after luminaires were washed, and C shows illumination after luminaires were washed and walls and ceilings were repainted.



MORTALITY RATE of incandescent lamps increases rapidly beyond 80% of rated lamp life, or after 20% of the lamps in a given group have failed. Also, light output of lamps which have burned 80% of rated life show a deterioration of initial light output of more than 15%.

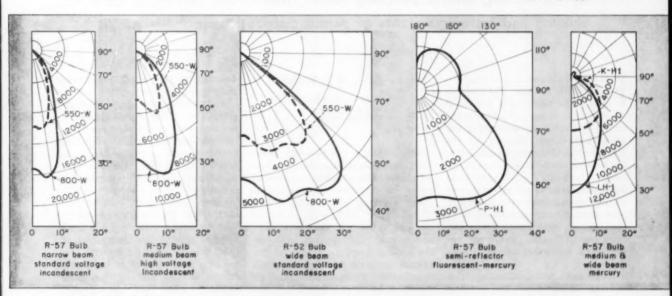
general-lighting purposes. In many cases it will be found economical to group replace after about 20% of the lamps in an installation have burned out for, at this point, the rate of burnout of a group of lamps increases very rapidly. The preferred time of replacement varies with different lighting installations but it can be determined accurately when all factors for a given installation are taken into account.

Incandescent reflector lamps may be used with existing equipment either with or without removal of the reflectors. Although not required with reflector-type lamps, separate reflectors or shields of some type are recommended for protective purposes where there is danger of mechanical breakage or where moisture condensation or water from a leaky roof may cause a hot lamp to crack.

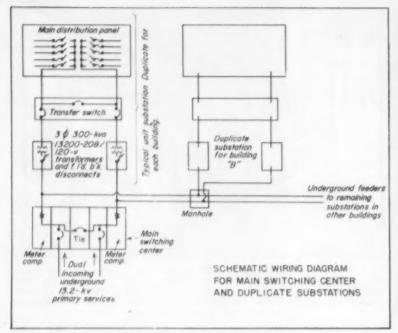
Reflector-type mercury lamps, like incandescent types, may be used with or without reflectors but require auxiliary equipment with a consequent higher initial installation cost. Regardless of this, due

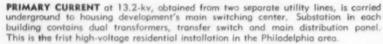
to their much higher lumen-perwatt output and long life, they are the most economical light source for a great variety of uses.

In any lighting installation where rising labor costs have resulted in lowered footcandles because of infrequent fixture cleaning, it will pay to switch to reflector-type lamps to halt the theft of light by industrial dirt. To do this there are available incandescent and mercury reflector-type lamps that will meet the requirements of practically every kind of lighting application.



LIGHT DISTRIBUTION patterns of reflector-type lamps are available in a wide range to meet the many lighting application problems existing in industrial plants and elsewhere. Curves for specific lamps are available from lamp manufacturers.







TIE BREAKER, linking the two incoming primary feeders, is manually closed only upon phone permission received from load dispatcher of utility company.

## 13.2-kv Substations for Residential

Multiple-building apartment development has dual underground 13.2-kv service feeders, central switching center, transformer station in each building and transfer switches to permit distribution flexibility.

IRST residential housing development in the Philadelphia area to be electrically served at 13,200 volts is an 1800-apartment group of buildings overlooking the Schuylkill River. Known as the Presidential Apartments, the complete development will include seven modern 11-story 255-apartment brick dwellings (four already completed), plus garage structures and drug store, laundry and cleaning establishment, department store and restaurant, theatre, numerous retail shops and other service facilities.

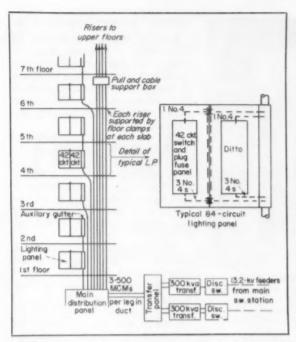
Apartment units—situated in a random layout on the rolling grounds of a former golf course are designed in the form of block By Edward J. Walsh

Electrical Engineer Shelly Electric Company Philadelphia, Pa.

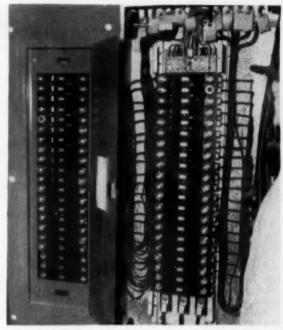
crosses having 219-by-48-ft arms, with elevators, electrical closets and all utilities contained in the central cores of the various buildings. Each building also contains two transformers (either one of which can carry the full electrical load) and a main distribution panel on the ground floor. Local control for branch circuits serving separate apartments is obtained through 2-section 84-circuit fused lighting panelboards; a separate panel serving each floor, and a separate

4-conductor riser serving not more than two such panels.

Main switching center for the complete development is located in the basement of the most-centrallylocated building, this switching center containing two underground 13.2-kv service entrances related to separate network systems, main disconnects, and a tie circuit breaker (closed only with permission of the local utility company's load dispatcher), master metering and line pilot indicating equipment. Dual feeders extend from this center (via floor trench) to the transformer station serving that same building and (via underground duct and manhole lines) to duplicate transformer stations located



**CONDUIT RISERS**, supported by beam clamps at each slab level, serve either one or two local lighting panels, with actual connections to panels being effected in auxiliary gutters incorporated in these units.



TYPICAL FLOOR PANEL is 2-section 84-circuit 120/208-volt fused switch assembly, with lugs at bottom of each section for connection of Number 4 conductors, and with solid neutral terminal blocks at top.

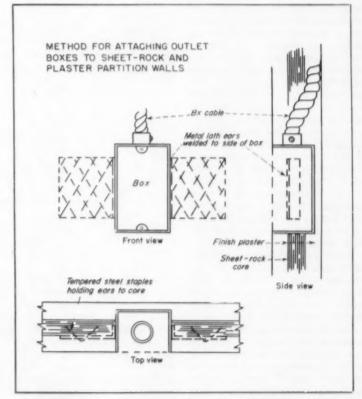
## **Service**

in each of the other apartment buildings in the group.

All transformer stations are equipped with two 333-kya units, full-load-break disconnects and a manually operated transfer switch. Transformers step power from 13,200 volts delta directly to 120/208-volt wye, with this secondary current being conveyed to related house distribution panels via 500MCM cables (3 per leg) supported overhead by trapeze racks.

#### **Dual Distribution Insures Service**

With dual primary service entrances, dual feeders extending to each building, duplicate transformers in each substation, a tie breaker at the main switching center and a transfer switch located between each transformer bank and its related building distribution panel, maximum protection against electrical interruption is obtained for the tenants. This is so because either primary is sufficiently sized to supply the demands



ALL BOXES were incorporated into partitions by means of metal-lathe ears or wings which were tack-welded to boxes, then temporarily stapled to sheet-rock core of partitions until permanently secured by coat of plaster.



UNIT SUBSTATION for pumping station contains 13.2-kv/440-volt transformer, circuit breakers and motor starters, float-control equipment and wet-cell battery for operation of high-voltage switchgear.

of the complete housing development, while each subfeeder and transformer can adequately carry the full load in any individual building. With these duplicate provisions for transmission and transformation, and with facilities for selecting or by-passing any distribution section, current continuity need not be disrupted for inspection or maintenance routines, repair work or partial utility outages.

Between basement main distribution boards and local floor lighting panels in each building, Number 4/0 RH cable feeders are carried upwards in conduit supported by clamps attached to structural beams at each floor level. Conduit risers connect directly to bottoms of auxiliary gutters incorporated in lighting panel enclosures and (when more than one floor is to be served by a riser), conduit is continued upwards from gutter tops to the other panels above.

Lighting panels are liberally sized, each 200-amp 42-circuit section measuring 40-by-48 in., with phase conductor lugs located at the bottoms and solid common neutral terminal blocks at the tops.

Branch circuits to apartments consist of 4-wire No. 12 armored cable, extended overhead from floor panels to separate 8-by-8-by-6-in. apartment junction boxes, this wiring being carried through ceiling cavities created by the prevalent bar-joist and suspended-ceiling construction of the buildings.



**AUTOMATIC SWITCHGEAR** rotates use of three sewage pumps when so dictated by timing relays. In event of total pump outage, distant city disposal center, also local attendants, are alerted by alarms.

#### Welded Ears Hold Wall Boxes

For mounting outlet boxes to sheet-rock partitions, the electrical contractor developed the interesting technique of tack-welding short sections of metal lath to both sides of each box, these lath sections then being bent outwards at right angles to form "ears" positioned half an inch behind box faces. Partition cores were then cut to receive boxes, the ears were temporarily stapled against sheet-rock core sections, and half-inch coats of finishing plaster were applied to both sides of wall cores. This procedure securely and permanently consolidated box assemblies into walls.

These coats of finishing plaster likewise made it possible to drop armored cables from bar-joist overhead cavities to wall boxes along the face of sheet-rock cores, thereby avoiding further channelling while yet obtaining a smooth wall surface for final decoration.

In temporarily securing lath ears of boxes, tempered steel staples were "sprung" into the sheet rock by means of a special tool; another technique developed by the electrical contractor. With this tool, staple prongs were driven into wall surfaces at opposing angles, buried staples thereby assuming the shape of flat round-bottom "V's" rather than conventional sharp-cornered "U's" (see sketch).

#### **Automatic Sewage Pumping Station**

Another interesting feature of this housing development relates to sewage disposal, for the suburban location of the apartment buildings on the banks of the Schuylkill is 20 ft below (and five miles distant from) Philadelphia's nearest disposal station.

This dictated the installation of a supplemental, fully automatic, pumping substation which (since low-voltage current was not readily available in this outlying section of the city) likewise relies on 13.2-kv power, extended from the utility tap, underground, for a distance of 1.000 ft.

Contained in this unit substation (this one stepping current to 440 volts) is a 60-cell 125-volt control battery for the operation of high-voltage switchgear, a distribution panel combining circuit breakers and motor starters, plus necessary float-control equipment for regulating level of sewage in tanks.

Pumps (three in number) are each sized at 125 hp and (through the action of time relays and an alternator) the pumps operate in rotation, thereby distributing the load equally between the units.

In the event of total pump outage, the distant city disposal center is alerted to this fact by means of an alarm circuit, activated by a float switch at the local pumping station.

Due to the potential danger of flammable gases possibly being generated in the underground collection tanks, all wiring in these chambers is explosion-proof.

While this overall installation is the first residential development in the Philadelphia area to utilize 13.2-kv power for primary service. it will probably be followed by other similar cases, for copper savings on the primary side of the system and reductions in utility bills are both sizable. In fact, by purchasing power at wholesale rates (that drop to the 9-mil level each month), savings approach \$10,000 annually; an amount which is quite welcome for amortizing the owner's initial investment in substation equipment.

Credit for this installation goes to Sweet and Schwartz, architects, Mayer I. Blum & Sons, engineers and designers, and to the Shelly Electric Company, electrical engineers and contractor, all firms being located in Philadelphia.

## Proposals for Electrical Installations — Part II

Marginal notes and comments on a specific type of proposition. Although used effectively by a successful electrical contractor, it is not offered as a standard form.

#### By Ray Ashley

Research and Consulting Engineer, Oak Park, III.

N an article last month propositions for electrical work were discussed in a general way. Here, a specific case will be reviewed. It portrays the opinions of an individual who has been successful in the electrical contracting business. In studying the proposition (Fig. 1) and the estimate (Fig. 2) we find that they have much to recommend them.

The letters (A, B, etc.) in the left margin of the proposition and the figures (1, 2, etc.) in the margin of the estimate are reference markings associated with various pertinent observations made in this article.

Study carefully the proposition or proposal reproduced in Fig. 1, then refer to the marginal notes and comments below explaining the basic reasons for inclusion of the various clauses.

#### The Proposition

A—The contractor attaches an estimate of the approximate cost to his proposition. The estimate, although conservative, is liberal enough to allow for contingencies and some additional work. Accordingly:

 If the customer wants some minor extras, the contractor can absorb them without exceeding his upset price.

2. If the job progresses as an-

ticipated, the total billing for the work will be less than the upset price. The customer's favorable reaction to this paves the way for future business.

B—1. The statement: "Billing for this work will be on our standard basis . . ." satisfies the buyer that he is not to pay more than other customers served by the contractor. It also leaves the impression that costs for electrical work are more or less standard.

2. The qualifying statement: "for this type . . ." leaves the way open for billing on another basis for other types of projects such as installation-only work or larger jobs that rate lower markups.

Billing details avoid questions later.

C—"Duplicate invoices". The buyer knows that he will get the right prices for material.

D—Labor hours. There can be no question about the number of hours billed if the customer has approved the time cards.

E—The brief outline of the work to be installed may be needed for a check-up later. It may also cause the buyer to check more carefully to see that he has not overlooked any of his needs.

F—The contractor calls attention to the fact that compliance with codes alone does not necessarily insure best engineering and construction practices.

G—The owner is informed that the intended installation will not represent the minimum requirements of codes.

In the written proposition there is one particular item to which many contractors will take exception: sending jobbers' invoices to the customer. The objections offered are:

- The buyer need not know what the contractor pays for materials.
- (2) Much of the material may be from stock.
- (3) Invoices suggest to the customer that he buy directly from the jobber.
- (4) The customer may ask for cash discounts.

With reasonable markups applied, there can be no harm in giving the buyer the base costs of material. If he is going to consider buying directly, he is just as likely to do so regardless of the type of billing used. In case he does get such an idea, the contractor has a selling job on his hands.

Research has advanced numerous findings that show why it is much better to have the materials procured by the contractor installing them. The buyer must learn that perchance he is able to buy as cheaply as the contractor, he cannot buy as well and that when he takes the procurement of materials

### A PROPOSITION FOR ELECTRICAL WORK (Names and addresses omitted)

Dear Sirs:

- We wish to submit an approximate estimate for an upset price of \$9,125.00 for the electrical work to be installed in department 5, building 2, of your plant at the above address. All work to be installed as hereinafter outlined.
- Billing for this work will be on our standard basis for installations of this type.
- Material will be billed at cost plus 10% for material services and return. Duplicate copies of jobbers' invoices for materials will be attached to each bill.
- <u>D</u> Labor will be billed from timecards signed on the job by your representative. 20% will be added to labor cost (payroll) for construction engineering, general overhead and administrative expenses, and 10% will be added for service return.
- E The estimate includes the installation of the following:

  2 15 hp, 3 10 hp, and 7 5 hp motors

  12 300 Watt RLM and 20 80 W. Fluorescent fixtures

  14 S.P. switches and 15 duplex receptacles
- E Certificate of electrical inspection will be obtained and paid for by us. In addition to complying with all rules of the local inspection department and the National Electrical Code, all work will be installed in accordance with the best engineering and construction practices.
- G Feeders, branch circuits and panels will be in excess of code requirements to take care of minor additions.

The cost of this work is guaranteed not to exceed \$9,125.00.

Respectfully	submitted
Ву	

out of the contractor's hands, he is inviting hazards. He must learn also that the contractor has to supply a service in connection with the materials regardless of who purchases them.

With or without invoices, customers have often asked if they were not entitled to a cash discount. Contractors are usually able to dismiss this question by truthfully saying: "Yes, but you did not pay cash".

Billing is simplified by attaching invoices. A single line giving the name of the jobber, the invoice number and the total cost suffices for billing all of the materials listed. The invoice also gives the customer a material check which may save the contractor much checking time.

#### The Estimate

Earlier in this discussion it was noted that the contractor attaches an estimate of the approximate installation cost to his proposition or quotation (marginal note A, Fig. 1). Justification of this somewhat unusual practice is outlined below in the marginal comments identified by leter with specific parts of the estimate illustrated in Fig. 2.

1. Invariably a buyer will be surprised at the quoted price. When he sees the estimate, it becomes apparent that there are no large items of cost and that the final price is the aggregate of numerous small items.

2. The material prices are accurate so if the buyer calls a jobbing house for a check, there will be no trouble in reconciling the estimated costs.

3. An item for contingencies is included. It is in proportion to the hazards of the particular job.

4. "Service and Return": One percentage (10%) of markup is used for material and it is labeled "Service and Return". This calls attention to the fact that a service must be rendered in connection with all materials selected and purchased for the job.

The word "profit" is not used. If questioned about the profit, the contractor can explain that only a small amount is to be realized and that the 10% markup will be largely used in the expense of selecting, purchasing, coordinating deliveries, etc.

Total of	PRICING	SHEET	DATE JUNE	1	1066
JOB OR BL	DE P. T. STONE CO.	LOCATION			
BKD TO	DEPT. 5 - 8104.2	ADDRESS			
ARCHT OR	ENG R	ACCIVES		-	
PLANS MAI	AKED	SCALE S	PEC. No.	EST N	0.
EST. BY	PRICED BY EXTENSIONS BY	CHECKED BY	8 O No.	-	EET No.
	MATERIAL	SUANTITY WATERIA		LABOR	EXTENSION
0	PRELIMINARY ESTIMATE		111111	II	11111
-	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
	2" GALY, CONDUIT - INCL. FTES.	100	56 00		
	3" GALY, CONDUIT . "	50	5800		
(2)	NO. 6 TYPE R WIRE	3000	240 00	-	
0	NO. 0 " " "	200	230-0		
	500 MCM	1	230-0		
	28 CAT. LTG. PANEL & CAR.		14000		
	300 W. REM FIRT. COMPLETE	1/2	7600		
	80 W. 2-LAMP -LUG. FIRT.	20	500 00		
	7	+			
<b>(D)</b>	4		100	-	
(D)	MISC. MAT. & CONTINGENCIES		9000	-	
V-10-1	CARTAGE & CONSUMED TOOLS		#000	-	
	CALINOS E CONSCINED 100ES				
(1)	TOTAL MATERIAL		\$ 18000		
	MAT. SERVICE & RETURN	10%	3/8 00		771111
	MAT. SELL PRICE			-	34940
0	LABOR - APPRENTICE ELECT.	220 NRS @ 2.	50 550 00	-	
-	CLASS A ELECT.	660 AND 6 3		-	
	FOREMEN	220 400 6 3	Fa 834	111	111111
	SUPERINTENDENT	10 443 E H	/4000		
		1111111 1111			
-			379000		
(F)	INSURANCE & DER TOOLS	15%	56850		
(9)	CONSTR. ENG'S & O.H.	20%	768 00	-	
	RETURN	10%	5/16 50	H	
	LABOR SELL PRICE	10 M	3// 50	-	SARA.
	THE COLUMN			111	Sidentu
	TOTAL SELL PRICE			III.	191264
				-	
	GUARANTEED MAXIMUM CO	72/2	3.00	-	
	BILLING TO BE FROM ACTUA	K GOST FOR	0000	1	

FIG. 2—The estimate attached to the proposition. Numerals in margin identify pertinent comment in the text of the article.

Note: The markup on material is nominal and not increased to carry part of the labor burden.

5. Labor. The contractor's experience leads him to believe that, for this buyer, a listing of the various rates is prudent.

6. Insurance and Tools. Although insurances and tools are both job costs and in proportion to labor cost, they are seldom combined as one unit. This contractor combined them, however, in hopes the buyer would be saved the annoyance of having the high cost of insurance staring him in the face. The insurances must be included, but the contractor insists that one should avoid making a special issue of them if possible.

7. Overhead. The 20% is applied to the base cost of labor only. Note there is only one markup (10%)

added to insurances. This is done for two reasons: (1) The contractor realizes that 10% is ample; (2) The contractor knows that there has been much trouble created by other contractors applying too great a markup to insurances.

It is not intended that the foregoing example be indorsed as 100% for all cases. The contractor who supplied the subject material did not offer it as a standard. He has made a study of writing propositions and has experimented with customers. As a result he varies his quotations according to the type of work and the anticipated reactions of the customer.

Regardless of the merits and demerits of the example, it has provided an excellent study that invites serious consideration by electrical contractors.



**SPECIAL BODY** on standard truck chassis provides mobile service unit for Dunn Electric Co., Columbia, S. C., with storage space for materials, tools, and two-way radio.



TWO-WAY RADIO permits continuous contact between mobile unit work crew and main office, saves time, insures prompt service to customers at all times.

#### **ELECTRICAL CONTRACTORS**

## **Speed Service with Special Trucks**

Custom design truck bodies are put on standard model chassis, and standard design bodies are custom-altered to meet specific needs of individual contractors.



**STANDARD BODY** on semi-trailer was altered to provide office and storage facilities with electric heat, fluorescent lighting and telephone for Hale Electric Co., Pittsburgh, Po.



**FRONT HALF** of trailer body is equipped as an office, complete with drafting table, file, plan rack and cabinet. Electric strip heater is under drafting table.



**WORK BENCHES** and complete set of tools are available in mobile units ready for use on every job, both standard and emergency calls.



STOCK BINS in mobile units provide working crew with adequate supply of normal wiring materials at all times on all projects. Stocks are replenished at shop every marning.

RUCKS play a major role in every electrical contractor's operation. Their basic job is the movement of goods. The type of electrical work done and the size of the individual contractor's operation established the trucking needs for that contractor. If he's a small residential wiring contractor, for example, the goods he has to move from freight yards or wholesalers warehouses to his shop, and from his shop to his customers' premises, will usually be light. But if he is a commercial or industrial wiring contractor, the products he has to move will generally be heavy. Volume per pound is another factor. These, and other considerations, will influence the contractor in his selection of trucks and types of bodies to do the hauling jobs involved. Typical of the types available are: carryall, pickup, panel, forward control, stake or van, semi-trailers, and trailers.

Time saving and cost cutting are also factors in selecting trucks. For example, take the case of Dunn Electric Co., Columbia, S. C. Its president, Joe W. Dunn, founded his business on the premise that prompt service and quality work are the key factors contributing to the growth and success of any business. In order to render prompt service to his customers, he decided he needed mobile service trucks fully equipped with materials and tools normally required

for the type of jobs he handles, which could be moved quickly from one job to another. Such service units, manned by good workmen and fully equipped, enables him to keep time-per-job at a minimum and to cut down on costs for travel and otherwise.

In order to meet his own specific requirements adequately Joe Dunn designed a special panel body for his mobile service units. These bodies provide storage bins for all types of electrical construction materials required on the average wiring, maintenance or repair job, as well as work benches, tools, etc. which enable the truck crew to handle most jobs direct from the

(Continued on page 234)



**INTERIOR** of body is shown here from rear of trailer, showing stock bins on both walls. Folding seats are for working crew, form covers for bottom bins when not in use.



**SECTIONS** are separated by locking type sliding door of expanded metal, for ventilation. Rear section (above) is heated by two 300-watt 5- ft sections of electric baseboard.

## EMERGENCY ELECTRICAL SERVICE

... for hospitals

Positive power protection for polio respirator patients is provided through installation of diesel generator sets operated in parallel and automatically regulated. Load transfer is initiated either by interruption of utility service or by sustained low voltage, with tripped circuits being restored to service in order of their importance.

By M. L. Beeson, Electrical Engineer, County of Los Angeles, Cal., and P. Belsky, Switchgear Engineer, Westinghouse Electric Corporation

WO recently completed California hospitals, designed for the medical treatment of poliomyelitis, emphasize the importance of reliable auxiliary generators (operating automatically in parallel) as essential parts of preferred-emergency transfer schemes. The importance of this stand-by power equipment is obvious, particularly so when we realize that polio respirator patients depend completely upon power-activated mechanisms to stimulate their breathing, and that even brief power interruptions could adversely affect their physical and psychological health.

It therefore becomes mandatory to provide independent standby power sources which will automatically pick up all essential electrical loads in the event of temporary utility power failures. This pick-up response should be prompt (within 10 seconds or less), reliable, segregated, and of sufficient capacity to maintain emergency service until normal utility service is again restored.

In each of the hospitals referred to, loads for critical respirator equipment added up to only 150 kw, so it was estimated that one small high-speed diesel unit would be adequate. It would also be practical from the standpoint of quick starting, low maintenance and moderate fuel charges. As an added insurance measure, however (to provide for the remote possibility of essential repairs becoming necessary during a utility power outage), it was decided to install two diesel generators instead of only one.

With two machines available, it then became apparent that additional emergency generating capacity was available for other critical hospital loads as well, and that the second generator constituted a reservoir of added power in the event that "epidemic" conditions increase the normal respirator demands.

To take maximum advantage of these two emergency units, load areas were classified as critical, semi-critical and non-critical. In an emergency, patients requiring continuous power would be promptly moved to a critical area, where service from either or both generators would be available. Respirator patients who could tolerate longer periods without benefit of an "iron lung" would be placed in a semi-critical area, where they would have the benefit of any surplus emergency power. Normal hospital power requirements would be satisfied only after these two priority sections received all necessary service.

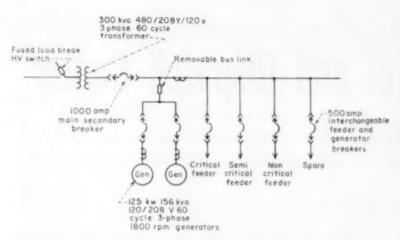
In order to minimize switching requirements, and to make either or both generators available at all times for any or all emergency circuits, it was decided to operate generators in parallel. This arrangement also shortened the normal-to-emergency power pick-up, the first unit reaching normal speed and voltage in six seconds and the second unit reaching full capacity in another three seconds.

As installed, both normal and emergency switchgear (including transformer and high-voltage loadbreak switch) is located in adjacent sections of the same packaged power center, with respective drawout breakers connected to a common low-voltage bus structure,

Normal utility power reaches this common bus through a selective-trip main secondary breaker, fused manual gang-operated primary load-break switch, and 300-kva dry-type air-cooled 4800/208Y/120-volt 3-phase transfermer. The main secondary breaker is of course interlocked with emergency draw-out breakers to prevent paralleling of utility and emergency services.

Diesel generators are nominally rated at 125 kw, 120/208-volt, 80% power factor, 60-cycle, 3-phase, 4wire. However, due to the use of oversized engines and liberal design, units can operate continuously at 125% of rated full load, without overheating any of the components. Engines are 6-cylinder watercooled (with radiators and fans). rated for 280 hp at 1800 rpm. Starting is accomplished by a 24volt battery, a spare battery also being kept charged and available for each engine through a manual transfer switch. Generators (directly connected to engine flywheels through flexible steel-disc couplings) are single ball-bearing units equipped with 125-volt dc directconnected exciters.

Each engine set, together with batteries and starting controls, is mounted on a structural steel baseplate. Components rest on separate vibration isolation mounts, while all control equipment (also battery operated) is enclosed in a separate



**EMERGENCY GENERATORS** are connected to low-voltage switchgear bus through draw-out breakers which are interlocked with transformer main secondary breaker to prevent paralleling of utility and emergency power sources. Removable bus link permits emergency service of isolated hospital load through 2 buses.

metal cabinet. In the event of overspeed trip, low oil pressure, excessive water temperature, generator overload or overcrank, attendants are notified by indicating lamps on the control board and an external alarm.

Also provided for each engine is a manual-off-automatic switch in the starting circuit, with a remote annunciator to warn the operator when the switch is in either the manual or off position. In the manual position the engine may be cranked until started and, in the automatic position, five 15-second battery impulses (with 5-second interruptions between) will occur before the battery is automatically

disconnected. After engines are started, they may be shut down by (1) turning the selector switch to the off position, (2) operation of the overspeed trip, or (3) operation of the automatic transfer switch, which would be actuated by the restoration of normal utility service. In the latter case the engine would continue to run for an additional two minutes before cutting out.

Automatic transfer to the emergency power source is initiated upon interruption or sustained low voltage (measured by an adjustable under-voltage relay) of utility service. On those occasions the main secondary breaker of the trans-

former opens, all feeder breakers except those related to critical areas are also opened, and diesel generators come up to speed and are automatically paralleled and synchronized (when rated voltage and frequency is obtained) on the low-voltage bus structure of the power center. Semi- and non-critical feeder circuits are then closed in sequence, up to the capacity limit of the emergency power supply.

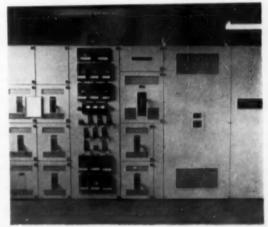
If either generator fails to start or synchronize, non-critical circuits are immediately blocked open, permitting the full capacity of the remaining operating unit to be used for critical and semi-critical loads. If an overload still continues, semicritical circuits are also blocked off by the tripping of a power relay. Reclosure of any of these blocked circuits (or any further adjustment of circuiting) must be accomplished manually by the operator in attendance. This same sequence of automatic blocking and tripping also occurs if (while both generators are in operation) one of them trips out due to reverse power.

For testing purposes, draw-out generator breakers can be partially withdrawn, disconnecting main contacts although leaving secondary control circuits energized. Engines may then be started, synchronized and a simulated parallel operation made without actually opening the transformer main secondary breaker. In the event that it actually does become advisable or necessary

[Continued on page 236]



CONTROL EQUIPMENT for each diesel engine, enclosed in metal cabinet, is mounted adjacent to corresponding power unit on the same steel bedplate. Indicating lamps and remote alarm notifies attendant of an over-speed trip, excessive water temperature, low oil pressure or generator overload. Engines are connected in parallel to simplify switching.



AUTOMATIC CONTROL equipment as well as manual closing and synchronizing features are mounted on a common hinged instrument panel to facilitate supervision and operations. Transformer main-secondary and incoming generator breakers are also mounted together in a common vertical section of the free-standing dead-front power-center switchgear.

## **Load Control and Dispatch Center**

Design received top rating in 19 of 21 items evaluated in selecting lighting system for modernization of TVA's several Load Dispatching Centers.

By William F. Appleton, Consulting Engineer, Chattanooga, Tennessee

A CELLULAR panel ceiling lighting system has been adopted by the Tennessee Valley Authority for relighting its several Load Dispatching Centers after comprehensive study, testing and rating of systems available.

TVA's Electrical Development Branch was asked by the Division of Power Engineering and Construction to assist in conducting tests which would form the basis for selecting and designing the best obtainable coordinated lighting and color scheme for installation in all centers spaced over its service area.

Existing lighting in the various dispatching centers, although similar as to type of luminaire and levels of illumination, was generally considered to be relatively poor in one or more respects. Semi-indirect stem-suspended fluorescent luminaires for general illu-

mination and open-type fluorescent show-window luminaires for the centers' system diagram boards and meter walls produced an average illumination on the horizontal work plane of less than 25 fc, while vertical board levels averaged 46 fc of spotty illumination with considerable reflected glare from the board and instruments. The resulting 12 to 1 ratio from high to low levels created a difficult situation conducive to potentially serious dispatching errors.

To minimize eye and mental strain and to improve working conditions for the dispatchers, who are occasionally shifted from one center to another to meet work load demands, it was decided to relight existing centers as nearly alike as possible as future rehabilitation permits.

Since several of the persons responsible for the solution to the lighting problem were unfamiliar with the latest practices and equipment available, it was decided to make sample installations of the various types of suitable systems for testing, study and evaluation, it being agreed that the system most nearly meeting the established criteria (see Table I) would be selected.

As time and costs precluded making complete installations of all available equipment, it was felt that comparative results could be obtained from partial installations of the various types of equipment.

Accordingly, an 8-by-8-ft light box was constructed on the ceiling of a typical Load Dispatching Center to be used for the tests. Although some conflicts and interruptions occurred in the course of the testing due to extreme dispatching activity during periods of inclement weather, etc., the on-the-spot tests had the important advantage of receiving first-hand reactions and opinions of the dispatching personnel to the comfort aspect of each system.

Prior to the actual tests, systems using incandescent lamps exclusively for general lighting had been eliminated. Calculations of electrical load and heat gain showed excessive connected wattage and resultant air conditioning loads using incandescent lamps. Further considerations with regard to the stated objective of maintaining proper overall brightness balance ruled out any system which would permit alternately light and dark ceiling areas. The final tests, then, boiled down to choosing among panel systems of several manufacturers for overall ceiling lighting, plus either incandescent downlights or fluorescent lamps for the border lighting of the diagram board.

#### TABLE I: OBJECTIVES

- 1. Provide comfortable and pleasant working conditions for occupants.
- Provide an average of 40 ft-c on the vertical system diagram board and meter wall, within a 3 to 1 ratio (60 to 20 ft-c) between top and bottom.
- 3. Provide a minimum average of 75 ft-c on the horizontal work plane (30 in. above the floor).
- 4. Maintain proper brightness balance throughout the space.
- Eliminate or minimize glare, specular and compound masking reflections from the meter faces, system diagram board, and operators' consoles.
- 6. Conform with present requirements of good lighting practice.
- Provide for future increases in illumination without replacing entire system and without destroying proper balance of other factors.
- Provide facilities requiring minimum maintenance, relamping, installation time and installation costs.
- 9. Provide for the best structural stability.



#### Systems Tested

System A consisted of translucent panels of "roll-up" continuous corrugated vinyl plastic plus 150watt recessed incandescent downlights having concave cross-section prismatic lenses to produce an asymmetric distribution of light over the vertical surfaces.

System B used the same translucent panels of the first test, extended to provide board lighting.

System C, which eventually proved to be the system adopted, consisted of 16- by 48-in. cellular panels of molded translucent polystyrene plastic with a pigment additive for color improvement. Semi-rigid panels were 1-in. thick, having a 1-in. square "egg-crate" grid pattern, and were used for both general lighting and board lighting.

System D was a lightweight, translucent, semi-rigid, preformed, symmetrically patterned, vinyl plastic panel 3 by 3 ft by 1 in. deep, used for both general lighting and board lighting.

System E was another of the translucent corrugated plastic systems, employing a rigid methyl methacrylate panel 3 by 4 ft for

both general and board lighting.

Results of the test using incandescent downlights showed poor color compatability with the standard cool white fluorescent lamps, which was objectionable to some of the personnel. In addition, hot spots and extremely bright specular-diffuse compound reflections on the board could be removed only by moving the downlights further from the board. But portions of the lenses then came into the field of vision of the dispatchers, and the required level of illumination could not be maintained. This system would have required 96 downlights for the board lighting alone at a connected load of 14.4 kw and a heat gain necessitating 4.08 tons of air conditioning. It was thus concluded that the system chosen must be completely fluorescent, and as noted above, succeeding tests were made on this basis.

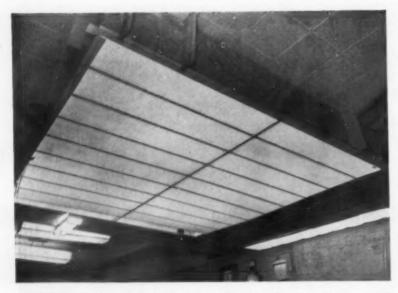
Systems B, D and E, while possessing certain advantages, had disadvantages making them less desirable than System C. Major disadvantages involved the suspension methods. T-tracks of one tended to bow slightly in the horizontal plane, binding the translu-

cent panels to the extent that positive and uniform distribution of air for air conditioning was prevented. Three systems had too many small parts for coupling and supporting the members, tending to reduce structural stability and materially increase erection time. Proper alignment and leveling was difficult to achieve using one system; another allowed no distribution of air through or around the panels.

Investigation of one plastic indicated that it tended to develop cracks and frayed edges after repeated rollings for relamping, requiring partial panel replacement. Another was too flexible for easy handling in inserting and removing it from the supporting system for cleaning and relamping. The panels of the last system were too large for immersion in the tanks of wash and rinse waters presently in use by the TVA for cleaning. Suspension rods at panel corners of one system made relamping difficult.

#### Conclusion

System C—the system chosen—most nearly met all the require-



**LIGHT BOX** used for tests consisted of two 4x8-ft plywood panels finished with flat white paint, mounted side by side directly against the ceiling, and a  $14\frac{1}{2}$ -in. deep plywood enclosure surrounding them. On these plywood panels fluorescent lamps with starter sockets and 2-lamp, 40-watt ballasts were mounted on 9-in. centers, the wiring permitting center spacing to be changed to 18 in. if desired. Lamps were seasoned for 200 hours before readings were taken and were kept burning continuously throughout the tests.

Footcandle and footlambert readings were taken following a grid pattern at 1-ft intervals over the vertical surface of the diagram board and at 2-ft intervals over the horizontal work plane (30 in. above the floor). The surface brightness for each of the plastic materials was obtained by averaging readings taken at 9 locations. Average brightness and reflection factors of the diagram board were determined by taking a series of readings at 12 evenly spaced locations. Factors for floor, meter wall and furnishings were determined following the same procedure.

TABLE II: RATINGS

Items Evaluated	Systems Tested				
	A	В	C	D	E
Horizontal illumination level	80	75	80	85	75
Vertical illumination level	70	75	90	80	75
Harizontal luminance level	73	77	85	82	77
Vertical luminance level	82	85	85	85	8.5
Vertical illumination ratio	65	8.5	90	8.5	8.
Illumination level uniformity	60	8.5	85	85	8.
Coefficient of utilization	85	85	90	85	8.
Surface brightness	80	8.5	90	85	8.
Reflection elimination	70	90	8.5	90	91
Glare elimination	70	85	85	85	8.
Color pleasantness	75	85	90	80	8.
Relative visual comfort	60	80	90	75	8.
Ability to increase illumination	80	85	85	85	8.
Erection ease	80	80	85	70	8
Structural stability	80	75	85	75	8
Life expectancy	75	80	90	70	8
System maintenance ease	70	75	90	80	8
Relamping ease	8.5	80	90	80	91
Air diffusing value	80	80	90	00	8
Connected electrical load	60	90	90	90	9
Heat gain	60	90	90	90	9
Total	1540	1727	1840	1642	176
Average	73.3	82.2	87.6	78.2	84.

Note: The evaluation figures are comparative figures based on 100 perfectly meeting the requirement for that particular item. The higher the figure, the better the evaluation for that item.

ments initially stated (see Table II). In all of the lighting qualities—illumination, luminance, ceiling brightness, transmission, reflection and glare reduction, color rendition, comfort and pleasantness—this material was excellent. The erection time was considerably shorter than for the other types because of fewer small parts. As the plastic panels had some strength themselves, and the supporting members were physically interconnected, the structural stability of the system was good.

The size, shape and construction of the panels made system maintenance and relamping easy. It was found that the panels lend themselves well to on-the-job cleaning. Spot relamping of the first burnouts is easily accomplished by removing only the one panel below the burnout. Air conditioning through this material was comparable to that of a perforated metal low-velocity diffusion outlet.

However, as the lamp center spacing of 9 in. used in the tests provided a somewhat higher footcandle level (approximately 95 fc) than requested, and, since an entire lighted ceiling would raise this value still more, a recalculation was made taking into consideration the available plenum depth of only 14 in. A resulting lamp spacing of 12 in. was adopted, to provide approximately 90 fc maintained on the horizontal work plane. To insure the average of 40 fc. maintained on the vertical system diagram board and on the rear meter wall, four rows of lamps on 4-in, centers were retained next to these surfaces.

Based on the determined brightness of the ceiling and the accepted standards for brightness ratios of three to one, color tonal ranges were established. Because of the necessity of having a wall color of high contrast with all of the many colors of tape to be used, a very flat medium gray was selected for the vertical surfaces. To provide relief from monotones, a somewhat lighter gray was chosen for the frames of all meters, the same color to be used for the sides of the dispatchers' consoles, while a mist green jaspe linoleum covered the desk tops. The variegated off-white asphalt tile floor was allowed to remain.

[Continued on page 123]



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KA-LUG'S snug design belies its brute easier when you're terminating in the tight spots!

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—a screwdriver for the smallest, an Allen wrench for the larger sizes . . . that's all you need for split-second KA-LUG installation. Hex body easily held during tightening . . . tapes with speed and neatness.





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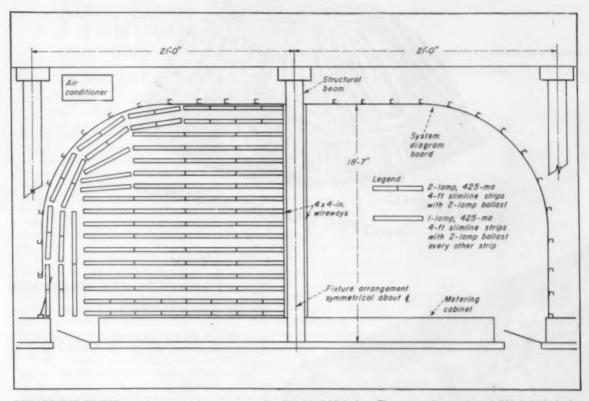
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DISPATCHING CENTER used for tests had an existing ceiling height of 10 ft 4 in. The system diagram board, 8½ ft high, had a medium gray flat finish with a grid of darker gray dots on %-in. centers over the entire surface. The system diagrams, indicating transmission lines, switching and substation components, consisted of symbols in multicolored plastic tape.

The straight wall in front of the operators was filled with small non-recording meters, telemetering equipment, recording meters and a clock. The floor was variegated off-white asphalt tile; the ceiling was cream-colored perforated acoustical tile. Sides of operators' desks were dark green; work surfaces and communications turrets were black.

#### **Electrical Details**

The permanent installation consisted of 44 2-lamp, 425-ma strips around the perimeter of the board and opposite meter wall, plus 106 single-lamp 425-ma strips for general illumination. Total connected load was 10.5 kw. One row of light strips was arranged to allow automatic switching to an existing emergency supply for the communications equipment in case of power failure.

A total of 118 16-by-48-in. cellular panels were used, some scribed to fit the curvature of the board. The 20-amp TW circuits to lamps were carried by two 4-by-4-in. wiring channels on either side of the ceiling beam in the center of the room. Feeders from the basement to the distribution panel outside the room provided 120/240-volt 3-phase power with the lighting load balanced on each phase.



**LIGHTING FIXTURES** consist of 4-ft 2-lamp 425-ma slimline strips along the perimeter of the system diagram board and the meter wall, and 4-ft single-lamp slimline strips over the remainder of the ceiling for general illumination.



END TO END

because

### XDUCT THREADS ARE MACHINED THEN GALVANIZED

Xduct threads are first machined, then galvanized to make certain every hill and valley receives the same protective zinc coating as the conduit itself.

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## **Practical Methods**

#### Exterior Elevator with Glass Cab Serves Double Function

MODERNIZATION

A new concept in elevator design has been introduced at El Cortez Hotel in San Diego. It is the 16-passenger "Star-Lift"—an exterior hydro-electric elevator complete with an all-vision glassenclosed cab. It provides elevator service from the hotel's main lobby up through the lobby roof and along the exterior wall of the hotel to the newly-decorated Sky-View rooms on the 12th and 15th floors.

Idea for this elevator innovation was more or less a product of necessity. The hotel urgently needed more elevator capacity to adequately handle its guests, plus tourists and community people, patronizing its remodeled plush Sky-View restaurants and cocktail lounges on the top floors. The major problem, which the hotel management passed on to the architect, was to find space for the new elevator. Installation of a new shaft adjoining the existing elevators would have involved a major and costly building alteration, and deprived the hotel of much valuable interior space, and furthermore seemed highly impractical.

Collaborating with the architect in his investigations of a solution to this problem was Elevator Electric, Inc., a local electrical construction firm specializing in elevator work. Jointly, they came up with the elevator design and control system which was subsequently installed. It is a combination hydroelectric unit, complete with fully collective-selective all-electric control.

The hotel management and architect decided not only to use the outside wall of the hotel for the elevator location, but also to capitalize on the idea, and to make full use of a glass-enclosed cab which would permit riders to enjoy the view from the hotel's prominent downtown location on a hill overlooking San Diego Bay, nearby Coronado, Lindberg Airport, and the surrounding hills and area to the West.

The 3500-lb. elevator cab is thrust upward with ultra smoothness, within guide rails attached to the building, by a column of oil from five electric pumps, operating at 220 volts. Each pump operates in a predetermined sequence to force oil into the shaft that houses the steel hydraulic ram. A neoprene "skinner" is employed for



**EXTERIOR ELEVATOR** provides novel and scenic ride in all-glass cab to Sky-Rooms of El Cortez Hotel, San Diego, Calif.

constant and automatic polishing of the ram.

Riding the rails also is a stabilizing "follower," which always maintains a midway position between the cab and the ground and insures maximum support for the hydraulic ram. Use of this stabilizing device provides maximum security, since it is attached to the rails which are through-bolted to the internal building structure. The cab literally floats on oil, perched atop the steel ram.

The glass cab has clear Plexiglas panels on three sides, to permit the unobstructed view of passengers in three directions, and a Plexiglas sliding door which slides in behind a metal panel on the building side of the cab. The allelectric pushbutton control panel in the cab is attached to the metal panel. Use of an attendant is optional; however, the hotel provides an operator, which experience has dictated is needed to handle the efficiently that appear crowds nightly to patronize the cocktail lounges and restaurants, and to ride the spectacular "Star-Lift." A photo-electric safety door is provided to allow passengers to turn in any direction to enjoy the view. The cab is made completely draftproof, is air-conditioned, and has piped-in music.

The control room is located be-



CONTROL ROOM provides fully collective-selective all-electric control for the five General Electric motors which pump oil into the steel hydraulic ram used to lift the cab.



Ask these questions, too, when you judge a fluorescent lamp...



Is your investment protected?

Check Westinghouse Fluorescent Lamps against any other brands you are now using. Check them for maintained brightness, long life, uniform appearance. If you are not entirely satisfied on all counts, your full purchase price will be refunded.



Is it built for good "lumen maintenance"?

Made exclusively with deterioration-resistant Halo Phosphors, Westinghouse fluorescent lamps maintain high light output to the end of their long lives.



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In the Westinghouse fluorescent family of 290 different lamps—including Slimline and Rapid Start—there's a type and size precisely right for every office, plant and merchandising application. Colors include seven different shades of "white" alone.



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WATCH WESTINGHOUSE

WHERE BIG THINGS ARE HAPPENING FOR YOU! low the lobby floor in a readily accessible space. An impulse received by a remote computer from the control panel in the cab, or from a floor location, signals the motors which activate the pumps. A unique feature of the remote computer is its ability to respond to floor or cab signals in the most efficient sequence, utilizing electronic memory.

The space between the guide rails up the side of the building is painted sky blue. Located on this blue panel are 100 stars, formed with neon light tubes in varying colors, which flash on and off in an irregular pattern to simulate twinkling stars—hence the name "Star-Lift."

Architect for this project was C. J. Paderewski. L. Teyssier was the general contractor. Elevator Electric, Inc., built the elevators, designed and custom-built the control apparatus, and did all the electrical work. Glass Elevator, Inc. has now been formed to build and market similar exterior elevator installations custom designed to meet specific requirements in other hotel, office, or similar buildings.

#### Lighting Has Prime Role in Store Modernization

LIGHTING

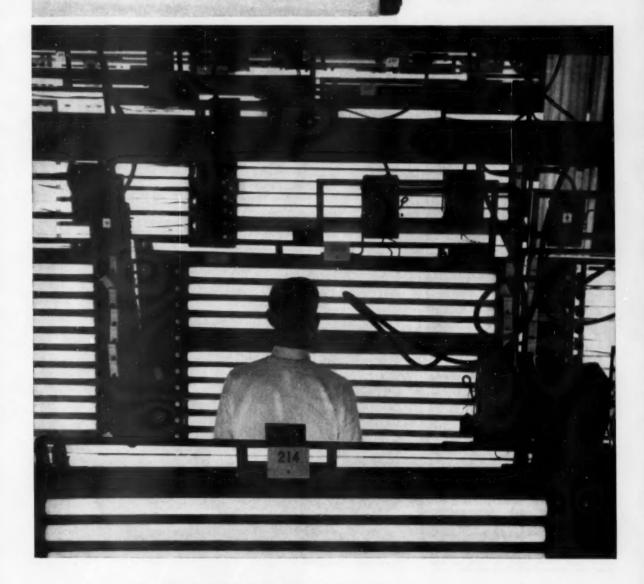
When the National clothing store in midtown Rochester, N. Y., recently became cramped for space due to increasing business, it knocked out one of its walls, extended the basement and first 3 floors for an average distance of 30 ft, then turned the job of expansion and modernization over to interior designer Amos Parrish of New York City, lighting and power consultants of the Rochester G & E Company, and to the Hickson Electric Corporation of that same city for planning and execution of electric details. Results attracted wellmerited praise and promptly boosted sales volumes, for decorative motifs are both colorful and harmonious, architectural features and furnishings are progressively modern, while a smart illumination plan combines imagination with variety to create pleasant visual environments and effectively highlight merchandise on display.

Many of these approaches are illustrated in the accompanying views of the new Men's Department, University Shop and Dress Circle; for these pictures reveal the judicious use of recessed incandescent downlights for general illumination, fluorescent valances located above and in front of wall racks, lighted wall niches to highlight special displays, adjustable spotlights in attractive housings to accent local areas, and large circular indirectly illuminated ceiling coffers that create an illusion of greater height and expanse in the various areas so treated. A backlighted frosted-glass artificial window panel in the University Shop provides additional interest by partially silhouetting displays



**RECESSED DOWNLIGHTS** provide an abundance of general illumination for open floor areas, while merchandise on wall racks and free-standing counters is high-lighted by shielded border strips and adjustable spots. Side-lighted artificial entrance flanked by arnamental coach lights also contributes variety in the Men's Department.

how to judge a fluorescent lamp ... point no.



## ask about QUALITY CONTROL

You would never guess it from their price, but fluorescent lamps today are precision products. (In Westinghouse fluorescent lamps, for example, you'll find mercury measured with the precision of a doctor's prescription, electrodes wound with fine-watch accuracy.) Thus only the closest quality control can give you the high light output, the long life, the good color qualities you expect from every single lamp you buy. Westinghouse quality control includes 480 inspections and tests for every lamp produced.

#### WATCH WESTINGHOUSE

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You don't baby the Knopp Voltage Testers. They're built to withstand the shocks of rugged daily use.

To save your time in testing you get the original patented Frod-Mount in the housing, making this tester easier and safer to use. You get the safety of dual indication of voltage by sciencid and neon lamp working independently. The scale readings are positive. Signal is by hum and vibration. Insulated for maximum protection.

It tells quickly if the circuit is open or closed; magnitude of voltage between 110 and 600 a-c or d-c, pure or rectilied; 25 to 60 cycles.

The Knopp Voltage Testers have won fame from coast to coast among engineers, electricians and power companies. So why pay more for a tester when the Knopp Voltage Tester gives you more features and more value at less cost.

There are two models to choose from: pick up one at your dealer today or write for illustrated, free descriptive Bulletin No. 425.

The KNOPF Phase Sequence Indicator

60 v. to 600 v.; 25
to 60 cycles; Rotating Indicator
shows sequence
A.B.C or C.B.A.
Lightweight
Compact. Big
time-saver.





4232 Holden St.

Oakland 8, Calif.



**INDIRECTLY ILLUMINATED COFFER** in this University Shop creates illusion of greater expanse, while use of table lamps, top-lighted wall niches and coves above suit racks combine visual interest with psychological comfort. Artificial window in background serves to partially silhouette displays placed directly in front of it.



**DRESS CIRCLE** features large circular ceiling coffer and attractive hanging chandelier. Valances above wall racks conjunctionally illuminate dresses and upper walls of salon, while swivel spots and back-lighted translucent curtains are used to further accent featured displays. General illumination at floor level is provided by recessed downlights.

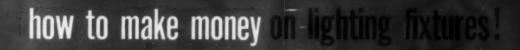
placed immediately before it, and, by brightening the corner, giving the impression of greater floor space. The "home" atmosphere in all of these newly-created areas is promoted still further through the additional use of graceful hanging chandeliers, ornamental wall bracket luminaires and artistic table lamps.

Thus by combining utilization of the additional floor space available with the ingenuity of lighting design, an atmosphere of superior shopping comfort has been achieved for the benefit of customers and employees alike.

#### Offshore Power Insured By Storage Batteries and Wind-Driven Charger

EQUIPMENT

Intake for Cleveland's water supply is located in Lake Erie, 26,000 feet offshore, where the water has a high degree of purity. This intake point is marked by a structure known as the "Five Mile Crib" and, between this crib and the city's Kirtland Street pumping station, a 9-ft-diameter conduit extends across the lake bed to supply the city with 125-million gallons of water



PICK A LINE that's well-designed and well-engineered. Design and engineering are absolute essentials of good lighting.

PICK A LINE that's quality-manufactured . . . tops in finish, metal fabrication and in assembly. Owners and users will appreciate your insistence on quality.

PICK A LINE that's designed with the contractor in mind. You'll find installations cleaner, easier and much more profitable.

IF you keep these things in mind, we know from experience good lighting installations bring you more and more jobs . . . and we know that Smithcraft will get its share (or more) of your business.

The Sheraton (shown above) is an ideal unit for offices, schools, stores, and all kinds of installations... very shallow... very easy to install.

Ask us to send you the current Smithcraft catalog
. . . it is a compilation of the newest and most
functional fluorescent fixtures in use today.

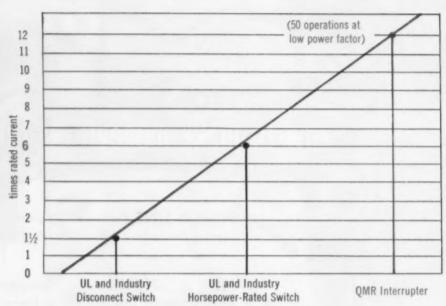
America's finest fluorescent lighting

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LIGHTING
CHELSEA SO. MASSACHUSETTS

## A new quick-make, quick-break

... with rated overload capacity 100% higher than industry standard! . . . with new margins of protection! . . . with heavy duty performance at a light duty price!





6.E.'s new Type QMR panelboard can interrupt power circuits formerly requiring larger, more expensive switches. Most fusible power panelboards are built to interrupt only six times the normal full load current of motors and other equipment to which the switch has been applied, meeting minimum UL and NEMA standards (see graph). The Type QMR interrupter has been tested and rated at 12 times the normal full load current, giving a capacity 8 times the UL standard for a disconnect switch and twice the standard for a horsepower-rated switch. Hence, the economical Type QMR panelboard can be used on power circuits formerly requiring a larger, more expensive switch. Interrupter ratings of Type QMR are coordinated with fuse ratings to give new levels of protection to both equipment and personnel.

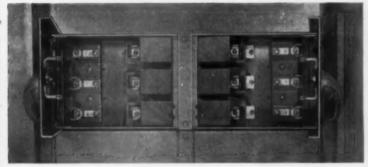






6.E.'s new arc chamber fences in the arc, breaks it into harmless segments—and snuffs it out. These drawings illustrate in sequence what actually happens during the instantaneous disconnect of the new Type QMR panelboard switching mechanism. The nickel-plated grids of the arc chute magnetically suck the arc away from the contacts, divide it, cool it, destroy it—all in one quiet micro-second. And since the action is spring controlled, the arc cannot be held by "teasing" the contacts. Pitting of contacts is thus minimized, temperature is kept low and safety margin extends far beyond rated interrupting capacity. The three-fold result: longer switch life, greater equipment protection, greater personnel safety.

## fusible power panelboard



Increased protection and greater savings. Higher I.C. and horsepower ratings on low ampere G-E switches give you added protection on your equipment and save money at the same time. You get quick-make, quick-break switching plus the security of fuses—heavy-duty operation for the price of light-duty equipment. Fuses can be changed quickly because of obstruction-free compartments.



Extra safety features. Interlocked unit door cannot be opened when switch is in ON position. Switch unit door latch padlocks "closed" to prevent tampering, "open" to safeguard working electrician. New improved "swing-close" lock on panelboard door withstands rough handling and gives additional security.



Easy Operation. A woman's touch—even with just the pull of a thread—can easily disconnect the circuit. Also, every QMR switch unit is calibrated for exact, uniform contact pressure—every switch unit!



Quick, inexpensive installation. Solderless lugs, ample wiring gutters and removable box ends speed up installation. In fact, one man can do the wiring, put on the front and, with the rotating adjustable clamps, adjust it to compensate for any misalignment of the box mounting.



General Electric's full line of improved quick-make, quick-break switches are UL listed. They offer increased protection for a complete range of installation requirements . . . and with fillers and pre-drilled bus bars, the Type QMR panelboard allows for quick, inexpensive expansion in the future. For complete details on the new Type QMR panelboard, write Distribution Assemblies Dept., General Electric Company, Plainville, Conn.

Progress Is Our Most Important Product

GENERAL ( ELECTRIC



For faster, easier box installations, specify the KEYSTONE QUALITY LINE



You name it and Keystone has it! Square cornered, bevel cornered, and non-gangable switch boxes. Octagon, square, and handy type outlet boxes. Plus bar hangers and bar-box combinations to meet every need. What's more, every item in the Keystone Quality Line is loaded with time-saving, cost reducing features. Knockouts and pri-outs are designed for easy, split-second removal. BX or Romex clamps are preassembled and nested in the box for easier pulling of wires. Holes for clamp screws are extruded to eliminate stripping of threads. Switch and outlet boxes are available with brackets for side or face mounting to studs. And the popular octagon outlet boxes are offered separately or in combination with deep or shallow offset bar hangers.

Yes, when it comes to wiring devices and wiring installation equipment, you can count on Keystone for the items you need when you need them. A complete new catalog describes the entire Keystone Quality Line. Send for your free copy today!

YSTONE MANUFACTURING COMPANY
23328 SHERWOOD AVENUE . CENTER LINE (Defroit) MICHIGAN

... the Complete Line of Wiring Installation Equipment



FIVE-MILE CRIB in Lake Erie protects Intake for Cleveland's water supply; also supports a weather station, navigational beacon and fog horn. Visible at top of maintenance-personnel penthouse is propeller-driven wind generator used to charge two 32-volt batteries.



BEACON LIGHT, fog horn, weather-recording and radio equipment, refrigerator and other desirable appliances are electrically powered by nickel-iron-alkaline storage batteries which are left unattended in discharged state each winter when ice calls halt to lake shipping.

daily. Steel-sheathed-concrete walls of the crib are 25 ft in thickness, rising from lake bottom to a height 40 ft. above the surface and surrounding a central tank having an inside diameter of 50 ft.

This hefty structure, if unmarked, could easily become a navigational hazard to night-time or foul-weather shipping. Therefore it is topped by a powerful beacon and fog horn. It is also desirable to have the crib manned with maintenance personnel, so the structure is likewise topped by living quarters and an offshore weather station.

To provide electric power for these navigational and weather aids, radio equipment, normal lighting, a refrigerator and other "household" appliances, two 27-cell nickel-

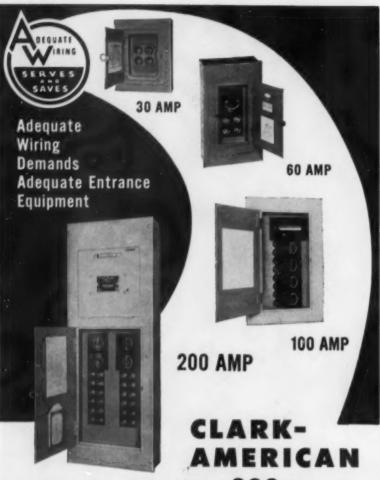
#### The Burning Question ...

of how to attain better welding efficiency is answered by the new, improved flexibility of SIMPLEX TIREX WELDING CABLES. These expertly designed cables are easier to work with, easier to handle. Their jacket of cured-inlead Neoprene Armor is the toughest known – engineered against damage by abrasion, oil, heat and water. Be <a href="mailto:sure">sure</a> – specify TIREX WELDING CABLES. Order from your distributor; or for complete data, write for Booklet 1011.

SIMPLEX WIRE & CABLE CO.,

79 Sidney St., Cambridge 39, Mass.





## offers 30...60...100...200 ampere SERVICE ENTRANCE EQUIPMENT

From the complete CLARK-AMERICAN line you can select the right type and size service entrance unit for any domestic electric load. For auxiliary use there are 30 ampere fuse panels. For small homes and summer cottages with medium appliance loads there are 60 ampere units, with main pull-out switches and additional pull-outs as required. To meet adequate wiring standards for medium size and large homes, there are 100 and 200 ampere units with a main pull-out, up to 4 auxiliary pull-outs, and up to 24 plug fuse branch circuits.





BATTERIES are used alternately to supply power to crib-mounted electrical equipment; one unit being charged while the other is in service. Due to dependability of prevailing offshore winds, charging insured through use fo propeller-driven generator. Battery mounted against wall is in its third decade of service and still delivering its full rated capacity.

iron-alkaline batteries are operated alternately. Batteries are Edison 32-volt units (a rarity), and one unit is charged by a propellerdriven wind-power generator while the other unit is in service. The propeller-driven charger supplants an engine-generator which, due to the fairly-constant presence of moderate- and strong-velocity offshore winds, was found to be unnecessary from a power-insurance viewpoint, since neither absolutely continuous operation nor constant speed is essential to charge the batteries.

Batteries of the nickel-iron-alkaline type were selected not only for dependability, but also to eliminate the need for maintenance during winter months when lake navigation is halted by ice. When this winter shutdown occurs each year, crib-keepers head for shore, leaving lights connected to the batteries which are gradually discharged. Batteries remain unattended until the opening of the following navigational season, at which time they are again charged and placed in service.

Performance has amply justified the selection of this source of power for, although one battery is now in its ninth year of service and the other is starting its third decade, both units still are delivering their full rated capacities.







Made to surpass the most rigid requirements of specification wiring jobs, P&S Super AC Switches can't be matched for durability, dependability and versatility of application. Use them AT FULL RATED CAPACITY for tungsten filament lamp loads, fluorescent installations, and at 80% of the switch rating on motor loads—the highest rating the National Electrical Code permits. Heavy silver-alloy contacts keep temperature rise at a minimum . . . a P&S Super Switch will handle full amperage 24-hours-a-day, seven-days-a-week.

The extra-heavy plastic body is designed to take more punishment than you could possibly give it. Its unique construction makes it virtually noiseless in operation. Totally enclosed, it can be mounted in any position. Write today for full information, including the report of the Underwriters' Laboratory Tests, to Dept. ECM-18.



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71 Murray St., New York 7, N. Y. 1229 W. Washington Bivd., Chicago 7, III. In Canada; Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

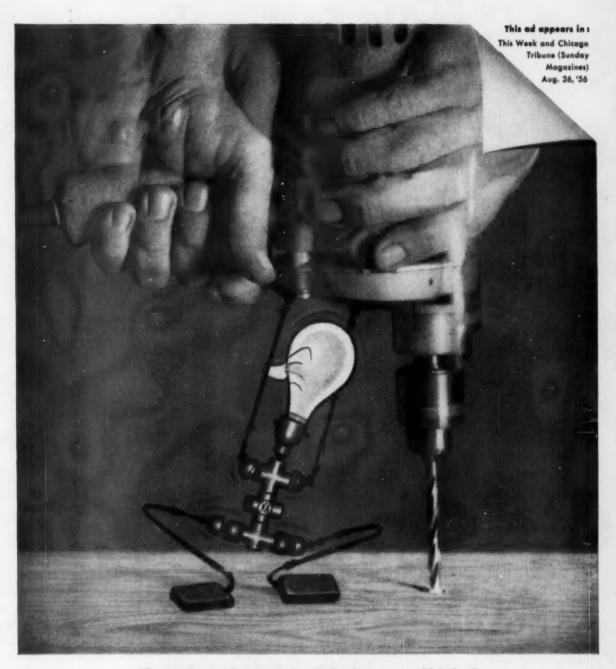
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Kennecott's national campaign for better home wiring with copper helps you get more profitable wiring contracts, more rewiring jobs.

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Send today for free reprints and poster-sized blowups of Kennecott's latest full-page national advertisements featuring "Skimpy Wiring." Get free copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary Home Wiring Wall Chart, mat service folder and list of at-cost prices of all material available. No cost, no obligation! Just write to Kennecott Copper Corporation, Dept. EC96, 161 East 42nd St., New York 17, N.Y.

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#### He makes slow work of do-it-yourself jobs!

Weak, undersized "Skimpy Wiring" actually holds back the electrical energy that gives muscle to motors. Don't expect new electric-drill bits or sharp circular-saw blades to speed your work if he is around. This current-stealing household pest can slow down and stall the finest power tools.

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# Totally Enclosed Class H Insulation

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ALLIS-CHALMERS

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Forcer all about maintenance with this Allis-Chalmers totally enclosed, 150 C rise, drytype transformer. No dirt, dust, moisture or lint can get at it. Use it indoors or outdoors. It is completely weatherproof.

Class H insulation used throughout the coil structure results in long insulation life. Case temperatures are low—do not exceed maximum of 40 C rise. All safety requirements are easily met. No vaults or barriers are needed.

Modern design features result in a compact, convenient transformer that will give years of satisfactory operating life. All these advantages are available at no extra cost.

For Complete Information, call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis. Coil has maximum insulation

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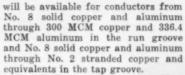
## **Product News**

#### Plug-in Panelboard Assemblies

A major development in panelboard design extends plug-in assembly of molded-case circuit breakers with standard enclosures to power and distribution sizes of the AB and AB-tribution sizes of the AB and AB-tributes. The new designs provide an integrated line of circuit breakers called StAB-breakers, with enclosures, called StAB-Inclosures, to meet a large number of panelboard and individual enclosed circuit breaker requirements by field plug-in assembly from stock of standardized components.

The new line will offer breakers in E to J frame, up to 225 amps, single to three pole, 240 to 600 volts, all designed for plug-in connection to mounting bases. Included in the line is an entirely new single pole, 50-amp, E frame breaker, the in. wide. Four panelboard enclosures are available, SE and DE, SJ and DJ with buses rated 400 and 600 amps respectively. Buses are symmetrical for top or bottom feed. Modular break-off blanking plates cover unoccupied portions of bus. Four AB-I enclosures with mounting bases for E, F, and J frames and external operating handles ac-commodate the full line of breakers to provide for individual enclosed circuit breaker applications.

Federal Pacific Electric Co., 50 Paris St., Newark, N. J.



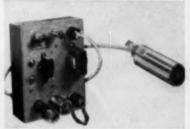
Burndy Engineering Co., Inc., Norwalk. Conn.



Indenter Tool (3

A new plier-size indenter tool has been announced for use with EMT. The new indenter requires less presure, is 10 in. long and weighs under a pound and a half. This pocket-size indenter is made possible by a 3-point compound leverage design with one center moving on a ball bearing that travels in a curved groove. This new tool gets into tighter places, is easier to compress and takes up less space in a tool box.

The Briegel Method Tool Co., Galva,



Limit Switch

(5)

A new industrial limit switch, known as a "proximity" limit switch, converts mechanical position or motion into an electrical signal without physical contact between the part and the switch. Available with either relay output or tube output (the latter eliminates all moving parts), the switch may be used in existing standard 110-volt control circuits. The relay type panel has an output capacity of 5 amps and the fully electronic or o amps and the runy section type has sufficient capacity to energize a small control relay. Since no mechanical contact with the switch is required, it has many applications in places where it is impossible or impractical to apply conventional limit switches. Sensitivity of switch is such that large parts can be sensed at distances up to 11 in. from transducer head. Small parts will actuate the device at a 1-in. distance. Bulletin is available.

Square D Company, 4041 N. Richards St., Milwaukee, Wis.



Clamp Connectors

A line of clamp connectors factory-

A line of clamp connectors factoryfilled with joint compound for aluminum or aluminum-to-copper connections, called "Stripseal". The connector grooves are filled with Penetrox, an oxide-inhibiting compound, and a plastic dip is applied. A rip tape under the plastic facilitates stripping the seal when the connector is installed. Connectors with Stripseal



A new ballast designed especially for operation of new Power Groove lamps. Ballast uses the rapid-start principle. For operation of two F48TG17/RS Power Groove lamps, this ballast is designated 89G732. As with 800 ma rapid-start systems, care must be exercised by fixture manufacturers in applying this new ballastlamp combination. Heat generation is high due to high lamp wattages, high current levels, and increased watts loss of ballast. Pendant type fixtures mounted eight inches or more from the ceiling with the bottom and top of the fixture open and no lamps positioned directly below ballast compartment are most likely to provide adequate ventilation. The new Power Groove fluorescent lamp will double the light output of present tubes of equal length. The increased light is made possible by a revolutionary change in tube design. It features a series of lengthwise dents or grooves along one side of the 8-ft-long tube.

General Electric Co., Schenectady 5,



**Power Drive** 

(6)

New Porto-Mite Super drive, an 84-lb power drive, is a one-man machine with four-legged stability. Gears are lubricated for life. Quick-acting power grip wrenchless chuck is standard equipment. Another feature is the fully protected motor switch which is recessed into the side of the machine where no unexpected starts or stops can be caused by brushing the switch. All parts are accessible. Unit has an aluminum housing. Bulletin is available.

Beaver Pipe Tools, Inc., Warren,



2-SCREW

## SERVICE **ENTRANCE ELBOW**

### Product Detail:

Fitting embodies a certified malleable iron body, with a water proof gasket and 2-screw steel cap.

Threads are cleanly tapped and molded smoothly to eliminate rough edges.

Thoroughly cadmium plated for protection against corrosion.

#### Sizes:

Fitting hubs are threaded to fit these sizes of rigid conduit: 1/2", 34", 1", 11/4", 11/2", 2".

 Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done-right-with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

Midwest Electric Mlg. Company



#### Circuit Breaker

A new current-limiting high speed dc circuit breaker operable at 1000 volts and 1200 amps continuous has been developed. Its primary applications will be for protection of generators, and traction or driving motors; also for feeder breakers and, in multiple pole assemblies, for anode protection. The FB-12 was designed for fast tripping and interruption of fault currents. It will interrupt in a total of .012 second, and limit current magnitude in .004 second. Breaker can be set for high speed tripping on either forward or reverse current. It is built in single and multiple pole assemblies, each with its own individual closing motor. It can be wired for individual pole reclosing or automatic reclosing.

(7)

I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.



#### Lumingire

The new "Ultra-Lite" is a fourlamp-in-one-housing luminaire for large area illumination. The mercury vapor lighting unit provides more uniform light distribution with wide coverage, better vision and high efficiency coupled with a modern appearance which suits it to lighting for shopping center parking lots, swimming pools, play grounds, beaches, amusement parks, etc. The unit consists of a circular, porcelain enamel steel housing, 52 in. in diameter, with four alzak aluminum oval reflectors evenly spaced around the center line. Each

reflector is equipped with a prismatic pressed crystal glass diffusing lens set in a hinged cover. Each of the four units makes up a mercury vapor luminaire. The use of this luminaire reduces pole requirements 50 to 75%. Unit uses four 400-watt mercury lamps, with transformers mounted in the pole base.

Revere Electric Manufacturing Co., Chicago 40, Ill.



#### Switch

New fuse-switch metal enclosed unit for industrial high voltage distribution centers provides flexibility for two feeds and four loads. The full 400-amp load break oil switch has three sets of manually operated links. Normally the upper set of links are open and two loads are supplied from each feeder separately. By opening either set of lower links and closing upper links, all four loads can be supplied by either feeder. Unit illustrated is Type "SCRA" rated 5000 volts, with high interrupting capacity power fuses. Similar units are available in 15,000-volt rating.

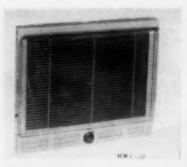
G & W Electric Specialty Co., 7780 Dante Ave., Chicago 19, Ill.



#### Motors (10)

Two new single-phase motors for farm equipment have been designed from test information and actual farm installations. The repulsion-induction motor is not harmfully affected by extremely low voltages and will operate satisfactorily without damage to the motor. Brush-holder parts are of aluminum, copper and stainless steel or bronze to resist corrosion. Motor has a built-in overload protector and is made in sizes from 1 to 71 hp, for use on silo unloaders, milking machines, feed grinders, elevators, conveyors and other applications. The capacitor motor is suited to use with equipment operating 24 hours per day. Made in sizes from 1 to 15 hp, motor may be used on ventilating fans, crop driers, irrigation pumps, refrigeration compressors.

The Pserless Electric Company, Warren, Ohio.



#### **Electric Heating**

A 2000-watt glass radiant heating unit is part of a new "High Heat Output" series. For large area heating applications, a single one of the new units can be used where two or three smaller units would have been used formerly. Models HW-20 and HWT-20 (with thermostat) have a tempered Pyrex glass heating element, capable of withstanding over 7 watts per sq in. output. An electrically conductive coating composed mainly of tin oxide is bonded to inside surface of glass, with silver contact strips fired along two opposite edges of the glass. Inner frame consists of conductive glass, ceramic corner support blocks, aluminum reflectors, bus bar assemblies and steel side channels. Unit is 26à in. by 22à in by 27a in. Knockouts are on back and bottom of unit for direct cable or conduit connection.

Berko Electric Mfg. Corp., 212-40 Jamaica Ave., Queens Village 28, N. Y.



Elbow

(12)

A new adjustable flat elbow has been added to the Cope line of cable trough to support power and control cables. It is of solid metal and will make any angle between zero and 90°. It usually is used where standard flat elbow of 30°, 45°, and 60° are not suitable, but it is particularly useful where constant changes in direction are required by the rerouting of cables. Available in standard trough widths of 6, 9, 12, 18 and 24 in. with the straight section available in lengths of 8, 11, 14, 20 and 26 in. The adjustable elbow is connected by the pin type coupler on one side only, and thus, is used as a hinge.

T. J. Cope, Inc., Third & Walnut Sts., Collegeville, Pa.

## BM

## INDENTER TYPE FITTINGS

FOR E.M.T.
Concrete-tight

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever.

Try B-M Indenter Fittings and get more profits from each job.



Red Throat Insulated Connector



Red Throat Cross section



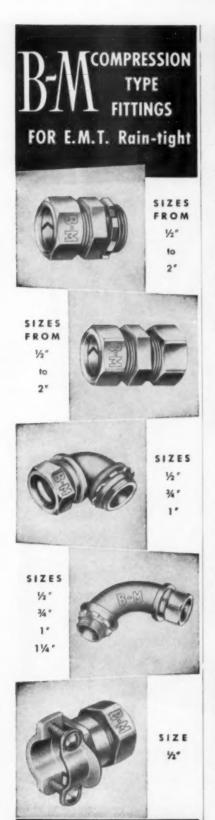
All B-M Indenter
Fittings are U.L. Approved
as concrete-tight and for general
use (File Card E10863). Also comply
With Federal Specifications W-F-406.



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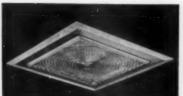
TOOL CO.

Warehouse Stocks in Principal Cities for Immediate Delivery!



BRIEGEL METHOD TOOL CO.

GALVA . ILLINOIS



#### **Lighting Fixtures**

A new line of recessed lighting units, called "Eliptisquares", has been developed for commercial, industrial and educational applications. The line is grouped into two-light and fourlight patterns to provide greater flexibility of illumination in a given area. Heart of the new multi-unit lighting patterns is the Amcolens, clear prismatic glass which directs light down. Either flush or drop-type Amcolenses are available to suit architectural motif. Only one plaster frame is used. Lighting flexibility can be achieved by individual or multiple switching control. Units are suited to use in schools, stores, lobbies, offices, etc.

The Art Metal Company, 1814 East 40th St., Cleveland 3, Ohio.



#### **Baseboard Heaters** (14)

A new "Solar Glass" baseboard panel uses Hi Intensity Silica glass in a construction which offers efficient heating and functional appearance. Solar Quartz glass is used in these new panels, developing 97% true radiant heat, non-drying, clean, without drafts or moving columns of air. Sizes of panels are: 600, 1000 and 1500 watts, for 120 or 240 volts-in 38-, 48- and 72-in. widths. They are 8 in. high, 2 in. deep, for recessed or surface mounting.

Electriglas Corp., Bergenfield, N. J.



#### Splicing Kits

A series of three new splicing kits for casting in-line splices in epoxy resin have been added to a general line of in-the-field splicing kits. The

new kits feature a convenient new split-mold which produces water-tight splices in the field in less than ten minutes. Once a splice has been cast, it is permanently encased in a block of insulating resin which will remain solid despite aging, heat and pressure. Design of the kits permits use of them underground or where splices are exposed to severe weather and moisture conditions. The kits have been used to splice cables feeding airport lighting systems and street lights as well as secondary utility circuits, overhead splices, signal systems and municipal lighting.

Minnesota Mining and Manufactur-ing Co., 900 Fauquier St., St. Paul 6, Minn.



#### **Lighting Fixture**

A new lighting fixture, called the "Leadlighter", has been developed for schools, lobbies, restaurants, offices and similar interiors. In the past, the use of reflector vanes in commercial lighting fixtures to shield the lamps has caused dark spots and streaks on the bottom of the fixture. The new fixture has slots in the reflectors, throwing enough light back up against the underside of the fixture to give uniform brightness to the entire area of the fixture. Dark spots have been eliminated and higher, more comfort able lighting levels have been achieved.

Leadlight Company, 800 100 St.,

Oakland, Calif.

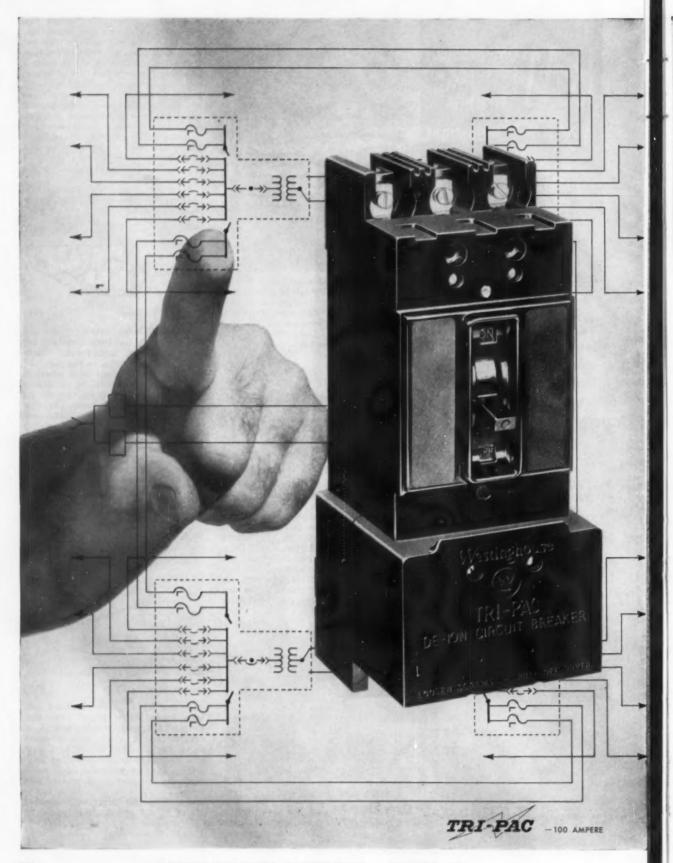


#### **Power Saw**

(17)

A new 31-in. power hacksaw has been named "Iron Mike". The saw weighs 16 pounds (without motor), is constructed of steel, uses a chain drive for positive action and cuts everything up to and including 3-in. steel pipe. Saw works by itself automatically and unattended, making uniform straight cuts. It can be easily mounted on the Freeman Universal Motor Mount and carried around to different jobs.

Areo Manufacturing Co., Grand Forks, N. D.



## 100,000 amps gets a new boss— the Westinghouse Tri-Pac breaker

The Westinghouse Tri-Pac breaker is the smallest protective device that can be used where 100,000 amps can be poured into faults. It combines the inherent advantages of both the molded case breaker and fusible current limiters to positively protect electrical circuits—throughout the range from overloads to fault currents that could build up to 100,000 amperes, if not stopped.

Co-ordinated triple circuit protection—thermal, magnetic, and current limiting—in one compact breaker. At much less cost than larger air circuit breakers of equivalent ratings and with more safety and convenience than switches combined with fusible elements. That's why Tri-Pac offers the most practical and economical solution to the constantly increasing interrupting requirements of network systems and those fed by large transformers.

The breaker trip portion of Tri-Pac handles overloads and moderate faults—eliminating fuse replacement headaches and costs. On higher currents, the current limiters in Tri-Pac trip faster, insuring the prompt protection required at those high currents. In Tri-Pac the current limiters and the breaker are co-ordinated so that the current limiter will trip at and above a point slightly under the interrupting capacity of the breaker. Below that point, the limiters remain undamaged, letting the breaker do the work.

Fault single phasing—a drawback of fuses—is averted by Tri-Pac breakers. The blowing of a current limiter actuates the breaker trip bar and all poles of the breaker open simultaneously. And when a high fault current is interrupted, indicating buttons on the current limiters clearly designate the troubled phase.

#### NETWORK SYSTEM PROTECTION

With today's increased use of network systems, the possibilities of 100,000-amp fault currents are not uncommon. New Tri-Pac breakers insure positive protection against all system current faults—large or small—at a new and greater economy.

#### HERE'S MORE INFORMATION ON TRI-PAC

A Westinghouse sales engineer can show you additional reasons why the new Tri-Pac breaker is your best buy for powerful circuit system protection. Call him today.

J-30215

#### **WATCH WESTINGHOUSE!**

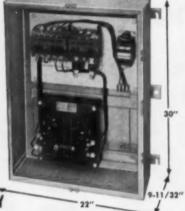
COVER THE PRESIDENTIAL CAMPAIGN ON CBS TV AND RADIO!

## PROTECT against Line Disturbances



#### REDUCED VOLTAGE STARTERS

SATISFY **POWER COMPANY** REQUIREMENTS



SIZE 2 30 H.P.

#### TYPE "TRA" **AUTO-TRANSFORMER STARTER** FOR GREATEST POSSIBLE STARTING TORQUE

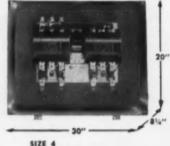
FEATURING: Advanced design, lighter, more compact with straight-thru wiring. Rugged auto-transformer with taps easily adjustable for desired voltage. Adjustable accelerating pneumatic relay. A-H bi-metallic thermal overload relays.

AVAILABLE: In NEMA Sizes 0 to 5, from 5 to 200 hp. NEMA I (General Purpose) or NEMA XII (Industrial)

#### TYPE "IRA" INCREMENT STARTER

FOR PART WINDING SQUIRREL CAGE MOTORS

Reduce current inrush on light or low-inertia starting loads by 2. step method . . . second winding energized after an adjustable time lag.



AVAILABLE: In NEMA Sizes 1 to 5, up to 400 hp at 440/550 volts. NEMA I or NEMA XII Enclosure.

These A-H Starters provide automatic operation with either 3-wire control or 2-wire thermostat control systems. Supplied with 3 poles for polyphase service, 4 poles for 4-wire service.

USE THIS COUPON TO SEND FOR COMPLETE INFORMATION



MOTOR CONTROLS WIRING DEVICES ENCLOSED SWITCHES APPLIANCE SWITCHES INDUSTRIAL CONTROL DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO. 103 HAWTHORN STREET, HARTFORD 6, CONNECTICUT

Please send me information covering:

- A-H Reduced Voltage Starters.
- The complete line of A-H Heating, Ventilating and Air Condi-

	e wrest with			
Others .			 	 

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co. oddress ...



**Battery Charger** 

(18)

A new automatic selenium battery charger is available for on location charging of lead-acid or nickel-alka-line industrial truck batteries. By operating a single toggle switch it can be adapted for batteries of either type. Automatic features of the new Rectox battery charger include fully automatic control of charging rate after initial setting is made; automatic shutdown when battery is fully charged; and automatic shutdown in the event of an ac power interruption. After power is restored, the charging cycle is automatically resumed from the point at which power was interrupted. Charger is designed for batteries ranging in capacity from 200 to 675 amp-hours. Nominal power input is 3-phase, at 220 or 440 volts and 60 cycles. Approximate dimensions of steel cabinet are 24 by 24 by 43 in.; and it can be bench or floor mounted.

Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.



**Incandescent Reflectors** 

Standard dome, shallow dome, deep bowl, rectangular angle, and symmetrical angle incandescent reflectors are available in all-white porcelain with apertured neck. Units are of one piece steel construction, finished inside and outside with white porcelain enamel on the steel, which seals the fixture against rust and corrosion. Available for pendant and angle hoods, tapped for 1-in. conduit standard, tapped for ?-in. conduit upon request. Outlet hoods adaptable to standard 3- or 4-in. outlet box shockabsorbing sockets available.

Electro Silv-A-King Corp., 1535 S. Paulina St., Chicago 8, Ill.



### WHY WASTE YOUR SELLING TIME ON BLIND CALLS?

**Dodge Reports on new construction** can help you sell more profitably by pinpointing your business opportunities.

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#### ALUMINUM SUPPORT SYSTEMS FOR POWER AND CONTROL CABLES

IN-FREE-AIR

DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

ease remember wo

"There is hardly anything in this world that some man cannot make a little cheaper-and a little worse. . .

OR APPROVED EQUAL

and be certain that YOUR approval gives your client:





A sound mechanical system.

A coordinated system with unit responsibility.

 An economical job—the lowest "Installed Cost." A system adequate for indoor or outdoors, for long spans and ideal for future expansion.

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> THE HUSKY SUPPORT SYSTEM—the only cable support system approved and recommended by all major cable manufacturers.

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.

5300 VINE STREET, CINCINNATI 17, OHIO

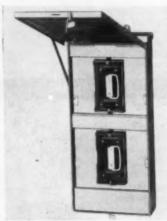


Pressure Switch

(20)

Less than 14 ounces of pressure will actuate a new door switch de-veloped especially for use with modern accordion-fold or sliding doors. Actual switch mechanism of device is made of a special silver alloy. Plunger is fully adjustable to make up for minor variations in installation. It can be installed in very narrow jambs. Box of switch itself is 2-11/16-in. by 1# in. by 1# in. The cover is 4-1/32-in. by 1-33/64-in. Switch is approved by UL. It is rated at 6 amps, 125 volts.

Pass & Seymour, Inc., Syracuse 2,



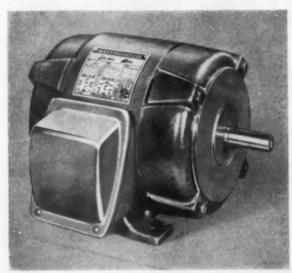
Service Equipment

(21)

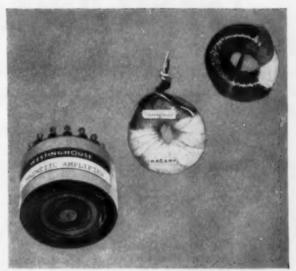
New 200-amp raintight switch was designed to control and protect the two separate 100-amp main lines to both the house and barn, by means of two separate 100-amp "Renu-Fuse" pullcover assemblies. It has two separate deadfronts, with improved latch arrangement which permits quick removal without removing screws, for wiring and inspections. It is also made with one 100-amp "Renu-Fuse" pullcover and one 60- and one 30-amp pullcovers. Pullcovers are ventilated and have heavy gauge copper contact blades and fuse clips, rigidly mounted to pullcover. Neutral is grounded and attached to cabinet. Cabinets and cover built of special rust-resisting steel.

The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

## HERE'S WHY DU PONT MYLAR® IS GOOD NEWS AT WESTINGHOUSE!



**SMALLER, MORE DURABLE MOTORS.** "Slot liners and phase separators made with 'Mylar' are thinner yet stronger... contribute to motor-size reductions," reports Westinghouse. "'Mylar' makes possible insulation with 7 times the physical strength and no reduction in dielectric strength when compared with conventional insulation—helps us obtain smaller, lighter motors that last up to 50% longer."



ELIMINATES REJECT PROBLEM. "When testing our 'Magamp' magnetic amplifiers under humid conditions, a high reject rate occurred. But when we started using 'Mylar' as the insulating material," Westinghouse engineers report, "the reject problem was completely eliminated. That's because 'Mylar' combines moisture insensitivity with high dielectric strength."

#### Can "MYLAR" help you develop new products . . . improve established ones?

These successful Westinghouse applications of "Mylar"\* are only two examples of the way industry is taking advantage of the unique balance of properties in this tough, flexible, transparent film. Besides its contribution to the electrical-electronics field, Du Pont "Mylar" is making possible better products for manufacturers in the automotive, construction, chemical, textile, sound recording, printing, and other major industries.

Whether you make guided missiles or ladies' hand""Mylar" is Du Pont's registered trademark for its brand of polyester film.

bags, "Mylar" may be able to help improve performance . . . increase the over-all value of your product. For more information on properties, applications and types of "Mylar" available, send in the coupon below. Be sure to specify the application you have in mind.



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

In Canada, "Mylar" is sold by Du Pont Company of Canada Limited, Films Division, P. O. Box 660, Montreal, Quebec.

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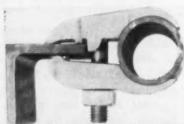


**Lighting Control** 

(22)

A new sealed cartridge photoelectric lighting control, known as the "Mark V", has been developed to provide sensitive, positive control of any lighting system which is to be coordinated with conditions of outdoor light. The unit is designed for street lighting, plant and parking area lights, airport markers, outdoor advertising lighting, trailer parks, etc. The basic unit has a molded plastic enclosure providing complete protection against moisture and dirt and against climatic changes. The unit also has a high-impact, break-resistant dome. In the event of failure of any tube or component, the controlled lights will be automatically and permanently illuminated until the trouble is corrected. Unit can be used with tungsten, mercury vapor or sodium vapor lamps, with adjustable timing characteristics for operation.

Tuttle & Bailey, Div. Allied Thermal Corp., New Britain, Conn.



Conduit Clamp

(23

A new type of pipe or conduit clamp, known as the "Latrobe", is made of malleable iron, cadmium plated to prevent rust and has a double bite of case-hardened tool steel. The safety bite is V-shaped to give a double bite into the steel frame to which it is attached. Attachment may be made without drilling holes in the frame work. The clamp is made in two models—one for right angle support and the other for parallel support—and in ten sizes for pipe or conduit from 1 in. to 4 in.

Fullman Manufacturing Co., 1211 Jefferson St., Latrobe, Pa.



## No Storage Problem Here!

Only Allis-Chalmers low voltage switchgear permits convenient storing of breaker in its own compartment with door closed!

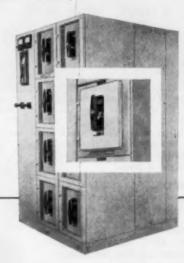


To give space needed when breaker is in disconnected position, center panel is reversed by simply loosening four knurled nuts. Ne tools are needed.

A specially contoured reversible center panel in each compartment door does the trick. When breaker is in test or completely disconnected position, the center panel may be reversed to extend outward from the surface of the unit . . . gives additional space inside cubicle.

This means no special storage space is required for breakers not in use. Handling and danger of damage during movement of breakers are eliminated.

As long as breaker is in compartment it is always firmly fastened to withdrawal mechanism and can't make contact accidentally;

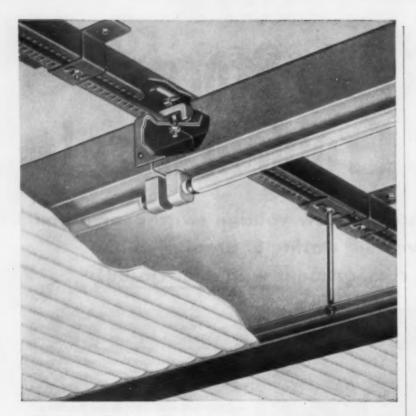


#### Get the complete story!

There are many other desirable features in Allis-Chalmers low voltage switchgear. For details call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



**ALLIS-CHALMERS** 



## Mult-A-Frame It!

### The quick and easy way to install luminous ceilings in any building

HERE'S HOW YOU DO IT: attach MULT-A-FRAME directly to present ceiling with standard suspension brackets. T-bolt-clamp fluorescent fixture to channel. Drop hanger rods from same channel. Drill through top of aluminum track and attach hanger rod with standard hexagonal nut. Lay in plastic ceiling and the job is done.

IT'S QUICK, EASY, ECONOMICAL: only tools required are a saw, drill and wrench. No skilled labor is needed and installation takes less time than with special materials. The result: a double saving—in man hours and cost per hour.

See our catalog in SWEET'S 3



write today for your free copy of the complete MULT-A-FRAME story told in the illustrated brochure, "Hold Everything." You can actually install a luminous ceiling at lower cost than a conventional one.

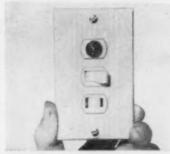
LIKE TO KNOW MORE: simply



Use MULT-A-FRAME as a raceway. Closure strips and end caps are available that snap into position at the pressure of your fingers.

#### MULT-A-FRAME DIVISION

Ainsworth Manufacturing Corporation 1471 E. Atwater St., Detroit 7, Mich.



Wiring Devices

(24)

A newly designed interchangeable line of wiring devices. Using one, two or three devices to a gang, the combinations can be assembled easily. They are locked into the strap with a twist of the screw driver, for the right combination of devices. Interchangeable components includes single pole, double pole, 3-way and 4-way switches; convenience outlets; pilot lights; pushbuttons; and duplex and triple outlets. All devices are interchangeable with other devices of the same type. Available in either brown phenolic or ivory thermosetting plastic, all devices meet U.L. requirements. All fit standard boxes and wall plates. Also available are one and two gang wall plates in brown and ivory metal as well as brown phenolic and ivory thermosetting plastic. Literature is available.

Leviton Manufacturing Co., Brooklyn 22, N. Y.



Truck Body

(25)

Production of an all-steel cargo enclosure for its 1, 1, 1, and 11-ton service bodies has been announced. The unit, designated Canopy Top, is designed for installation on the company's Service-Master all-purpose service body. It is 24 in. high, providing a 53-in. floor-to-roof height when bolted to compartment tops on each side of body. Strap-hinged double rear doors are equipped with a two-point rod lock which is operated by a keyed, automotive-type handle. A 10-in. by 15-in. window is installed in each door and in the head panel. Two full-length shelves are furnished on each side. It is available for installation on bodies now in use. Literature is available.

Service-Master Division, McCabe-Powers Auto Body Co., 5900 N. Broad-



### You can't beat SPANGLEAM EMT for bending!

You have to see it in action to believe the workout that SPANGLEAM EMT samples get from SPANG's qualitycontrol inspection crew!

A length pulled from each lot of SPANGLEAM is bent like a pretzel to assure you that the continuous weld and the SPANGLEAM finish will stand up under the severest bends you would ever need on any installation.

Then, just to make sure, the thinwall conduit is bent double, twisted and practically destroyed to see how long the weld and the finish will last under this abuse. Any premature breakdown of the finish or weld means the whole lot is discarded . . . a rare occurrence at SPANG!

Spang's inspection team is on your side, representing you in the mill to be sure you get a top-quality product every time. That's why the Spangleam EMT you use on the job is so easy to

work with. Quality-control manufacturing processes produce uniform wall thicknesses... the weld is strong, smooth and uniform... the finish does not crack, chip, blister or peel.

You'll find the same care practiced on Spang HD and Spang Black, too. So, buy top-quality conduit . . . buy Spang for easier, faster, better installations. Your local Spang Distributor carries the complete Spang line. See him for top-quality Spang Conduit. He will give you top-quality service, too.

## SPANS CONDUIT

#### SPANG-CHALFANT

Oivision of The National Supply Company GENERAL SALES OFFICE: TWO GATEWAY CENTER, PITTSBURGH, PA. District Offices and Sales Representatives in Principal Cities

#### Porcelain Products introduces

## a Brand New Concept ...OUTLET BOXES

of Fiber Glass Reinforced Plastic



The newest product offered to the electrical industry . . . Porcelain Products "FRP" outlet boxes provide the EXTRAS . . . not found in any other type. Molded of fiber glass reinforced polyester, with standard round knock-out holes and non-metalic clamps (if desired), it combines the strength and lasting qualities of steel . . . with the desirable electrical properties of plastic. Porcelain Products "FRP" outlet boxes are ideal for replacement or new construction . . . especially where moisture or corrosive atmosphere is present. Contact your electrical wholesaler or write direct for further information and catalogs.



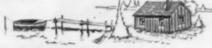
FARM BUILDINGS

HOMES



INDUSTRIAL

WHEREVER MOISTURE OR CORROSIVE ATMOSPHERE IS PRESENT



Porcelain Products, Inc.

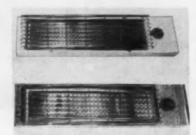


**Level Control** 

(26)

A new dynamic type switch for the detection of fluid levels, called "Dynatrol", provides fail-safe operation. Features of the new unit are: simple, no-packing, floats, flexible shafts, bearings, close tolerances, vacuum tubes, long probes or critical adjustments, small and rugged, positive action—sensitive only to level variations, accurate to 0.01 inch, versatile—any mounting position or media, standard model explosion proof 115 vac SPDT, rated 1000 psig @ 150° F. in. NPT with further miniaturization possible. Unit consists of a motor-generator driven at resonant frequency by an ac input. The generator output energizes a relay to control operation of any type of electrical equipment.

Automation Products Inc., 3030 Max Roy St., Houston 24, Texas.



**Heat Panels** 

(27

A new line of fully-automatic, vertical mounted ceramic radiant heating panels is available in chrome or baked white enamel steel housings. Although designed for supplemental or complete electric heating of bathrooms in new or existing construction, the panels are also well suited to heating of kitchens, dressing rooms, or any room where wall space is narrow or limited. Units are made in 500-, 750- and 1000-watt sizes and feature the new ceramic panels which are compact and have high wattage density to provide a radiant heat panel of unusually low cost per watt. Surface mounted units which are 75 in. wide, 315 in. high and 2 in. deep are prewired at the factory. A built-in thermostat and pilot light are on all units.

Heatmore, Inc., Throop Ave., Brook-

lyn 6, N. Y.



## FREE! 22 pages of ideas for profit where · when · how to use PARAGON TIME SWITCHES

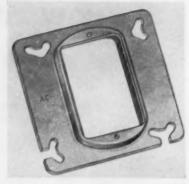


Here's a tremendously valuable book packed with facts you need on all Paragon time controls for commercial, industrial, home and farm use. Easy to read . . . fully illustrated. Every switch is crossindexed to make selection a

matter of seconds.

Remember—time is money! You'll make more profits if you buy and install the right time control the first time—and always buy PARAGON.





#### **Box Cover**

(28)

The "Y-Slot" cover fits all 4-in. sq boxes, for single device installation in any position. The "Y"-shaped slots in each of the four corners, permit the box screws to be hooked wherever they are located. Thus the job of installing covers for horizontal or vertical switches and receptacles becomes simple.

Arrow Conduit & Fittings Corp., 129 30th St., Brooklyn 32, N. Y.



**Fused Cutout** 

(29)

The S&C Positect, an enclosed fused cutout of the bayonet type for distribution load switching, has been redesigned to provide greater versa-tility in application. Line terminals have been changed to the pressure bar type, for use with either copper or aluminum conductors, accommodating a broader range of conductor sizes. To provide reliable service in coastal areas or contaminated atmospheres the leakage distance of the 5 kv, 100-amp Positect has been increased to match the 7.5 kv Positect. The auxiliary sleeve liner is now made of a special arc-extinguishing plastic, confining, minimizing, and extinguishing the arc during load switching. Porcelain of the 100-amp Positect is glazed in a light brown. It is available with interrupting capacities of 10,000 and 12,000 amps asymmetrical for the 50- and 100-amp sizes, respectively, with 14,000- and 16,000-amp one-shot fuse protection; it is also available for full load switching of load currents to 200 amps and associated magnetizing and charging currents, without external

S&C Electric Company, 4433 N. Ravenswood Ave., Chicago 40, Ill.



SCORES OF APPLIANCES available to today's homeowner make even 100-Amp service entrance questionable.

#### HOW LONG BEFORE YOU SAY, "100-Amp service is obsolete"?

It may be sooner than you think!

More capacity is needed almost day by day. First it was 60-Amps. Now 100-Amps. And people in some areas are already talking about 150-, even 200-Amps. The flood of new appliances clothes dryers, ranges, freezers today, central air conditioning and the heat pump tomorrow—is fast changing our ideas of what is adequate service.

It's good business to give your customers the capacity they'll need in the future—with Anaconda Silvaline\* Type SE Cable. Available in wide range of sizes

and ratings in copper or aluminum, Silvaline offers many advantages:

 Eliminates complaints – silver finish takes any type or color of paint . . . does not become sticky, flake or peel . . . will not mark walls.

2. Direct to range—Silvaline can be installed from pole to house to meter in one run and then to range. No conduit

needed. Fully approved. Saves time.

3. Long Service Life—Silvaline is the only service entrance with URC† saturant and finish.

Available from your Anaconda distributor. Write for descriptive folder on Silvaline Type SE Cable to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

\*Reg. U. S. Pat. Off. †Utilities Research Commission

## ASK THE MAN FROM ANACONDA FOR SILVALINE SERVICE ENTRANCE CABLE

SILVALINE TYPE SE CABLES—

self-vulcanizing tapes over neutral	100-AMP RATING OR MORE		
glass-cotton braid saturated and finished with URC-type compound neutral conductor stranded conductors	Conductors	Insulation	Roting (in amps)
silver finish	3/C #3 with #3 or #5 neutral	RH-RW 75°C	100
RH-RW insolution	3/C #2 with #2 or #4 neutral	RH-RW 75°C	115
ANACONDA	3/C #1 with #1 or #2 neutral	RH-RW 75°C	130
	with #0 or #1 neutral	RH-RW 75°C	150
THE STREET AND ADDRESS OF THE STREET,			

# for the new Sylvania Television Plant...





Three steps of power transformation in the new Sylvania Television Plant are supplied entirely by Uptegraff transformers. From the 2500 KVA power transformer shown at the left to the 120-volt lighting transformers shown on the page at the right, electric power is distributed by Uptegraff units.

Located in Batavia, New York, this is one of the world's largest and most modern television plants. Advanced engineering practices are employed throughout, to provide the ultimate in production facilities. The selection of Uptegraff transformers for this vital function of providing all the electricity for power and lighting is a tribute to the high quality and dependability of this equipment.

The power transformer is liquid-filled, rated at 2500 KVA, 34,400-4160 volts. The distribution transformers are dry-type air-cooled units, rated at 750, 300, 225 and 112½ KVA. In all, seven Uptegraff transformers are in service in this plant.

Uptegraff makes Power, Distribution, Instrument and Specialty transformers. Sizes are from 0.1 KVA to 10,000 KVA, 115 KV. Designed and built to meet or exceed all applicable NEMA, AIEE, ASA and other standards.

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FERGUSON ELECTRIC CONSTRUCTION CO.,
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CONTRACTO





## TRANSFORMERS throughout!

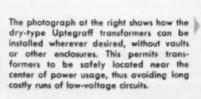


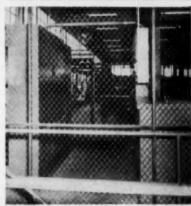
Shown here (left and right) are two of the four Uptegraff dry-type transformers used to provide both power and lighting current from the same distribution system, thus avoiding the duplication of units, common in the past. Two of the transformers are 750 KVA, and two are 300 KVA. All four are fed by 4160 volt circuits, and have 480Y/277 volt secondaries.





At the left is shown one of the Uptegraff dry-type transformers that provide 120-volt power. Two of these transformers are used, one being a 225 KVA unit, and the other 112½ KVA. Both have 480-volt primaries and 208Y/120 secondaries.





R. E. UPTEGRAFF MANUFACTURING CO. SCOTTDALE, PENNSYLVANIA

## BORTHIG

makes Insulating Varnishes to meet requirements that are...

A good tough general purpose insulating varnish—with an ample safety margin of proven performance—is what you need for ordinary applications. However, when exceptional durability, adhesion and flexibility are called for, or for applications designed to operate at temperatures in excess of 155°C., you must have extra toughness.

### TOUGH!

**BORTHIG K-252**, with its excellent penetration, bonding, adhesion, waterproof and oilproof properties, is an established, reliable, clear baking varnish that will operate at Class B temperatures. K-252 is also entirely compatible with the modern treated fabrics and papers.

Meets MIL-V-1137A grade CB, type M specifications.

### TOUGHER!!

BORTHIG K-3829 EPOXY BAKING VARNISH is a clear, thermo-setting varnish which requires no activator and cures entirely by heat induced polymerization. It will fit into your present baking cycles. Laboratory tests and field experiences show K-3829 to have higher values for adhesion, wet and dry dielectric, bonding and corrosion resistance at higher temperatures (up to 165°C.). It is recommended to meet the toughest conditions of operations.

SOLVED PROBLEMS are another product we deliver





Time Switches

(30)

A new series of double-pole doublethrow time switches offering heavyduty capacity. Listed as Model No. 1962/77, the U.L. approved switches will be invaluable in applications requiring transfer from one circuit to another, the controlling of mechanically-held contactors or motorized valves, and alternation from a high to a low heating control. Top contacts rated 30 amps, 3000 watts (incandescent lamp load rating), 1.0 hp, 345 volt-amps (pilot duty rating), at 120/240 volts ac. Bottom contacts rated 15 amps, 1500 watts, hp, 175 volt-amps at 120/240 volts ac. is available in four basic dial styles, standard 24-hour On-Off dial, astronomic (for follow-the-sun lighting), skip-aday (for eliminating week-end operation), and 7-day (for varied daily schedules on one dial), in flush, watertight and surface mount hous-

Tork Clock Company, Inc., Mount Vernon, N. Y.



Receptacles

(31

A new line of outdoor weatherproof receptacles and switches with "Flip-Tite" spring-hinged covers. Modern in design and construction, the line features non-corroding exposed parts and springs, and spring-hinged covers tightly seal the inner components against weather and moisture. The covers open more than 90°, permitting easy access to the device inside. Literature is available.

Royal Electric Co., Inc., Pawtucket,



## Keystone Aluminum Conductor System Installed at Penna. R.R. Shops ASSURE 7 WAY SAVING IN WEIGHT...POWER...LABOR

THIS IS AN immense project—the new car repair shop of the Pennsylvania Railroad. The shop is 2760 ft. long; 15 overhead cranes are required with capacities up to 25 tons. To furnish electrical connections for the cranes two 3-rail Keystone Aluminum Conductor Systems, each running the full length of the shop, were specified and installed.

Keystone was judged best qualified to meet the rigid conditions required of this installation. It was selected because it would . . .

SAVE TRANSFORMERS—Three installations needed with steel conductors are eliminated with Keystone Aluminum Conductor System.

SAVE FEEDER RUNS—With this non-magnetic system, all but the center tap is eliminated.

SAVE BOOSTER CABLES—System capacity permits satisfactory operation  $\frac{1}{2}$ -mile from feeder without boosters.

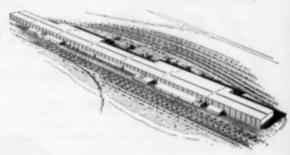
SAVE CAPACITY—Compact design permits close conductor spacings, minimizing impedence drop, reducing conductor size.

SAVE ENGINEERING COSTS—Integrated package design, factory assistance reduce time and effort.

SAVE INSTALLATION COSTS—Lightweight components, factory prefabrication, foolproof design cut erection time and cost.

SAVE OPERATING COSTS—Adequate voltage supply assures maximum crane operating speeds, reduces motor overloads. Protected contact surfaces eliminates shutdowns on exposed systems.

Keystone Aluminum Systems are now operating countrywide on AC and DC runways from 50 to 2760 ft. long, and on ore bridges and unloaders. Standard components range from 500 to 1000, 2000, 3000 and 6000 amp. capacity. Write today for case histories—"Solving Conductor Problems."



NEW SAMUEL REA SHOP at Hollidaysburg, Pa. where 50 steel hopper and gondola cars will be rebuilt each day. Large photo above shows 5 of the 15 overhead cranes, 2760-ft. runway; insert shows close-up of Keystone three-rail collector assembly. The Harry F. Ortlip Company of Philadelphia, specialists in railroad engineering and one of the largest electrical construction firms in the East, made the installation for Pennsylvania Railroad.

KEYSTONE



smooth tapering pipe threads for 21/2 to 4" pipe or conduit. Cuts standard, over or undersize threads. Excellent for steel, wrought iron, brass, copper or cast iron pipe. Simple construction—easy to set up and use. Take our tip-it's tops.



#### WORKS AS GOOD AS IT LOOKS

This 75 lb. power vise makes threading, cutting and reaming a fast, simplified operation when out on the job. Carry it practically anywhere. Sturdy tripod legs, self-centering jaws and quick-acting wrenchless chuck. Polished aluminum housing-dependable geared action-precision construction throughout. Get your order in early for this fast-moving profit maker.

#### TOLEDO PIPE WRENCHES

The wrench for everyday work load punishment. Unconditionally guaranteed TOLEDO quality. Sturdy frame and jaw, positive grip, quick easy adjustment. The wrench for your heavy-duty jobs. See it today. Try it out,

THE TOLEDO PIPE THREADING MACHINE CO. Toledo 4, Ohio





#### **Lighting Fixtures**

A new line of incandescent lighting fixtures, including steel and Alzak aluminum concentric ring luminaires as well as a broad variety of downlighting fixtures-both surface and recessed units. For surface mounted accent lighting, the line includes single and twin bullet spots with swivels and/or goosenecks in satin aluminum finish. Five types of satin aluminum drums in pipe and tapered types with Alba glass or Holophane lens provide application flexibility for a variety of wattages and lamp types. Semi-recessed units with skirts of perforated or polished aluminum comple-. ment a line of eight recessed high hat units having a variety of louvers, lenses, and apertures available in both fixed and adjustable lamp styles including gimbal ring and eyeball fixtures.

The Miller Company, Meriden, Conn.

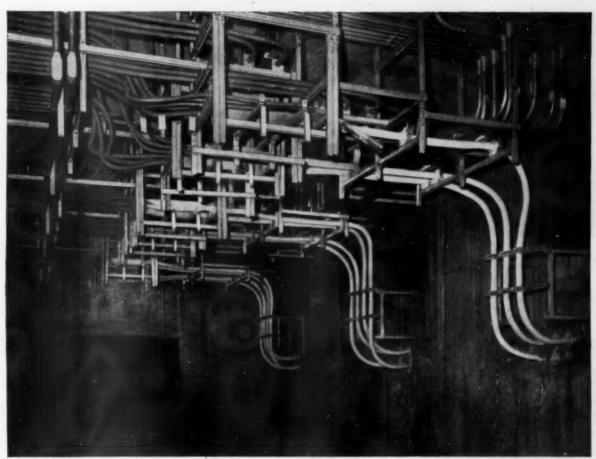


#### Circuit Breaker

(33)

A new dual-rated circuit breaker for the protection of equipment designed to operate on either of two different voltages-such as 6- and 12volt dc or 110- and 220-volt ac. Units have two ratings: 2 and 4 amps, 5 and 10 amps, etc. with separate load connections for each rating. Because of its hydraulic-magnetic operation, the circuit breaker ratings are unaffected by ambient temperature. Dual-rated units are available with one of three inverse time-delay characteristics or in an instantaneous-trip form. Maximum voltage is 480 ac; 125 dc. Bulletin No. 3430 is available.

Heinemann Electric Co., 413 Plum St., Trenton 2, N. J.



High voltage cable support and conduit racking in large municipal power plant.

#### How UNISTRUT® framing makes complicated electrical installations quicker, simpler

Looking for a modern, foolproof way to speed up complicated supporting of conduit, cable and other electrical equipment?

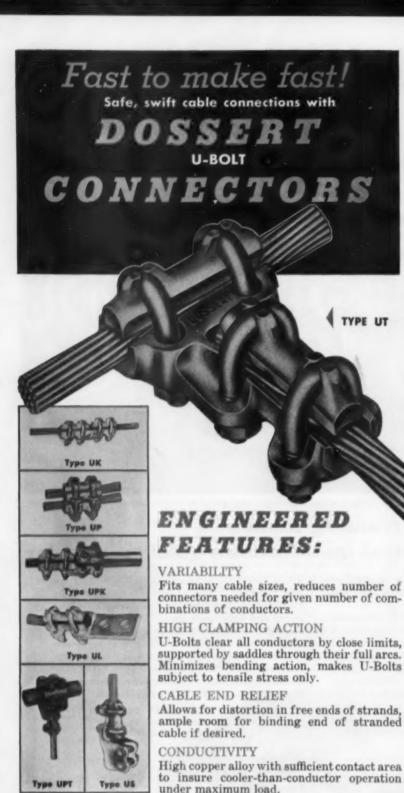
Extra strong, all-steel UNISTRUT adjustable framing is your answer-you assemble it right on the job from stock UNISTRUT channel and fittings. Concrete inserts, clamps, insulators-all are available in the complete UNISTRUT System. Costly welding, drilling and riveting are eliminatedwith UNISTRUT, everything bolts together; fittings are attached and adjustments made while work progresses. And you get a clean, professional installation strong enough to support the heaviest run.

You'll also want to know about UNISTRUT for wire raceways. With this unique system (listed by Underwriters' Laboratories) you run lines for both power and light inside the UNISTRUT channelmaking a flexible installation that accommodates irregularities, and permits wiring in at any point.

For complete information on these most modern electrical installations, send now for UNISTRUT Bulletins. Consult your telephone directory for name of nearest UNISTRUT Distributor.

### 933 W. Washington Blvd., Dept. E-9 Chicago 7, Illinois

The World's Most I		UNISTRUT PRODUCTS COMPANY Dept. E-9, 933 W. Washington Blvd. Chicago 7, III.
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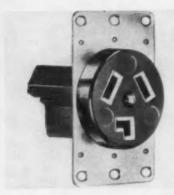


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IN CANADA: W. S. Gerrie & Assoc., Ltd., Toronto

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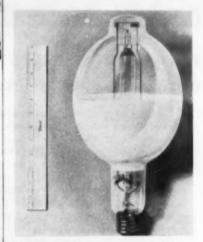


#### **Power Outlet**

(34)

A new 3-wire polarized flush power outlet—50 amps, 250 volts—may be installed easily due to straight-thru wiring and pressure-type terminals. The terminals, accommodating Nos. 6, 8 and 10 wire, are recessed. A 3-hole strap assures mounting flexibility. Outlet may be mounted in a 2-gang box, or in a 4-in. or 4-11/16-in. square box with a plaster cover. Wall plates are available in brass or stainless steel, brown (Type 7985) and Ivorylite (Type 7985-I), with 2-gang plates also available with ground slots and contacts. Device is listed as standard by U.L.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.



#### **Mercury Lamp**

(35)

A new 1000-watt mercury lamp has been developed with an interior phosphor reflector which directs two-thirds of the light downward. The lamp, designated G-E H1000 RC 15, is in the same group of lamps which includes the H1000 A 15, a clear glass 1000-watt mercury lamp and the H1000 RC 15, a phosphor coated 1000-watt mercury lamp with improved color. The new lamp has the phosphor coating on the base half so that two-thirds of the light output is directed down and one-third up. Thus less light is controlled by the external lighting

# SORGEL is the Name to Remember

When planning electrical distribution in industrial, commercial, and institutional buildings, keep in mind SORGEL dry-type transformers

#### Big savings . . .

can be made in the original installation cost by transmitting electric power and lighting current at higher voltages to load centers, then stepping it down to the utilization voltage with Sorgel dry-type transformers.

**SORGEL** transformers are so compact that they do not require much space, and can be installed in most any convenient or out-of-the-way place inside of buildings. They do not require fire-proof vaults nor enclosures.

**SORGEL** dry-type transformers are so quiet in operation that they are particularly adaptable for indoor installations — in hospitals, libraries, schools, institutions, office buildings, stores, and other structures where low sound levels are an important factor.

#### A Perfect Partner for Substations

**SORGEL transformers,** either dry-type or Askarel-cooled, can also be incorporated in substations, complete with primary and secondary switchgear. They are procurable with any make of switchgear, and from any substation manufacturer.

INCREASED EFFICIENCY — Installation close to the load centers results in shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

#### SAFE, LOW OPERATING TEMPERATURE.

LIBERAL DESIGN—Can safely carry an overload during an emergency.

**EASY INSTALLATION** — Attached mounting brackets.

EASY CONNECTING — Roomy connection compartment with solderless terminals.

LONG LIFE — Thermo-vacuum impregnated windings brazed to terminals.

#### UNDERWRITERS' APPROVED -

SORGEL dry-type transformers are Underwriters' approved in all ratings covered by the Underwriters' Re-examination Service, both single phase and 3-phase.



Also Saturable Reactors and Special Transformers

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

## The answer to industry's need for a QUALITY safety switch—



Type SCSD Standard Duty Switch. Capacities — 30 to 200 amperes, 250 volts AC and DC and 600 volts AC, 2 and 3 pole single throw.



Type SAHD Heavy Duty Switch. Copacities — 30 to 1200 ampores with front operated handles, 250 volts AC or DC or 600 volts AC or DC in 2, 3 or 4 pale tingle throw.



Type SCSD-R for raintite application

For the finest in safety, dependability, long-lasting and trouble-free switching, install @ type SCSD, standard duty or SAHD heavy duty Shutlbrak operating switches.

Approved by the Underwriters' Laboratories' Inc., for label service, these switches embody all the latest features in design and construction which makes them outstanding for all switching purposes — motor control, service equipment, etc.

Both types of switches are horsepower-rated. Both feature quick-make and quick-break, made possible by a shuttle mechanism with heavily silvered contacts, which roll under pressure and improve with use.

Another outstanding quality of the type SCSD switch is that it combines both interlocking and non-interlocking switch features in one unit.

Kamklamp pressure type of fuseholders with solderless pressure connectors, rotary operating handle to indicate "on" or "off" positions are other features. The rotary handle has space for 7 padlocks.

Dominant qualities of the ® SAHD include an interlocking fuse door which automatically locks when the current is "on" and permits access when the switch is "off". (An intermediate position of operating handle provides access only to authorized persons.) Handles are arranged with padlocks in "on" or "off" positions.

For further information about these new and better switches consult your nearest ® representatives listed in Sweets or see them at your nearest ® distributor.

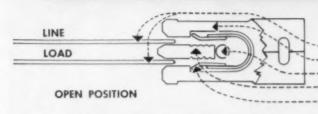


### Type SCSD and SAHD SHUTLBRAK SWITCHES

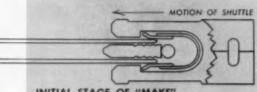
For heavy or standard duty



HERE'S WHY FA SHUTLBRAK SWITCHES ARE OUTSTANDING.

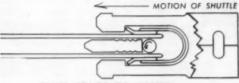


- A dramatic view of the famed shuttle mechanism, a feature of all @ Shutlbrak switches, in actual operation. The illustration shows:
- 1. Silver plated line and load contacts
- 2. Shuttle housing
- 3. Silver plated full floating, self-aligning main roller contact.
- 4. Ceramic Barrier
- \_. 5. Auxiliary contact tip.



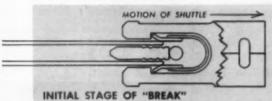
INITIAL STAGE OF "MAKE"

6. Auxiliary contacts engage the tapered free ends of contacts guiding the main roller contact in correct alignment with the stationary contact.

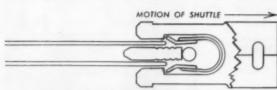


FINAL STAGE OF "MAKE"

7. Motion continued, placing main floating roller between the stationary contacts, as maximum contact is reached, the "U" shaped spring adds pressure, causing high pressure line to contact.



8. Main roller leaves surface between stationary contacts with no arcing Auxiliary contacts maintain path for current.



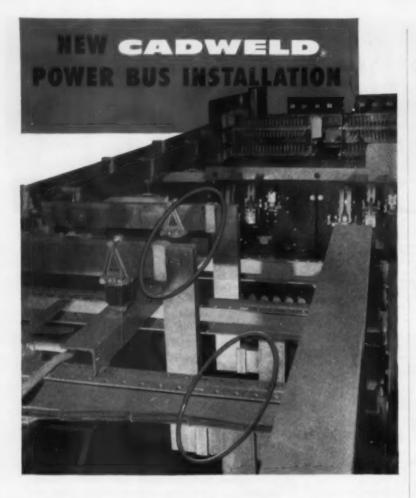
FINAL STAGE OF "BREAK"

- 9. Auxiliary contacts open (with dublbrak action) reducing the arc and carrying it to the outside of contacts, away from main contact surfaces which remain free from pitting.
- 10. After repeated operation under load, the main contact roller becomes highly polished proving main contact roller is moveable and presents new contact surface at each operation. The more frequent the use the better the contact surfaces become.

Frank Adam Electric Co. busduct . panelboards . switchboards

BOX 357, MAIN P. O . ST. LOUIS 3, MO. Phone JEfferson 3-6550

Makers of. service equipment . safety switches load center . Quikheter



PATTERSON-EMERSON-COMSTOCK, INC., Pittsburgh Electrical Contractor recently completed an electrical power installation for the JONES AND LAUGHLIN STEEL CORPORATION at their Seamless-Tube Stretch Reducing Mill, Aliquippa, Pennsylvania.

The  $\frac{1}{4}$ " x 4", 600V. bus extends from the generator control board to the variable voltage control panel. The panel alternately feeds sixteen 200 H.P. driving motors from a 2000 H.P. motor generator set.

CADWELD Bus Connections were recommended by P.E.C. to J. & L. for 4 major reasons:

- 1. Economy on original installation.
- 2. 100% current carrying capacity.
- 3. Compactness of finished weld.
- 4. Permanent—cannot loosen or corrode.

Before figuring your next bus installation, investigate CADWELD.



Erico Products, Inc.

2070 E. 61st Place

Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

fixture. For a given lighting level, it is claimed that cost of lighting from the new lamp should be about 15% lower than with the H1000 RC 15 lamp. The new lamp offers better maintenance, improved light distribution and some color improvement. It has the same advantages and characteristics as the H400 RC1 lamp. The new lamp is 15½ in. long, has a mogul base and is rated at 53,000 lumens.

General Electric, Nela Park, Cleveland 12, Ohio.



Trolley Bus Way System

(36)

The new Lec-Trol-Feed enclosed trolley bus way system supplies power of up to 300 amps at voltages up to 575 ac or 250 dc. The system's three insulated aluminum bus bars are arranged in a delta pattern and are completely enclosed in an aluminized steel housing. Maximum electrical leakage distance is provided by the delta conductor arrangement and petticoat-ribbed insulators. Bottom safety covers prevent accidental contact from below with current carrying members. It may be used either indoors or outdoors. Track sections are 30 ft long and available in 100-, 200-and 300-amp capacity. A complete line of accessories is available.

Electric Service Manufacturing Co., 17th and Cambria Sts., Philadelphia 32. Pa.



**Control System** 

(37

New remote positioning control system with plug-in modules, enables both positioning and proportioning control, plus monitoring of remote equipment over one circuit. Modules are designed especially for integration into other switchgear or control equip-



## where high octane fumes require maximum safety, airline maintenance shop demands Okocord\* cables

In 1952, Capital Airlines installed heavy-duty Okocord cables on all their portable tools and explosion-proof trouble lamps. The change was made only after Capital officials had investigated cords supplied by many leading manufacturers and were fully convinced that Okocord provided the safest possible service where high octane fuel and vapors were present.

Foday, the company still uses Okocord exclusively for this type of work. According to Capital's Safety Director, C. F. Schaub, here's why:

"The cords used in aircraft maintenance work get rough handling and frequently come in contact with chemicals, such as cleaning compounds, paint thinner, acetone and hydraulic oils, that weaken cord sheaths badly. Then, too, you've got to use these cords inside plane wings and parts of the fuselage where gas vapors are highly concentrated. It doesn't take much imagination to guess what'd happen if a cord shorted there. We have to use the very safest—Okocord!"

Okocord can help you solve your cable safety problems too. For full details, contact your nearest Okonite representative or write for Bulletin EE-451, The Okonite Company, Passaic, N. J.

3171-A

\*This product formerly carried the trade name Hazacord



where there's electrical power ... there's OKONITE CABLE



TUBE-WELD

**FITTINGS' SCREWS** 

ARE STAKED PERMANENCE!



With Tube-weld's oversized hardened steel set screws, you'll eliminate fumbling and costly waste of time when working

in high or tight places. This, plus longer length for easy wire-pulling, heavy gauge one piece construction that cannot open or spread, selfcentering box connector shoulders, lustrous zinc finish and easy-to-locate packaging are just some of Tube-weld's features. Available in 1/2", 34" and 1" sizes. Brochure on request. BLECTRIC TUBE PRODUCTS, (A Subsidiary of Berger Machine Products, Inc.) Plant & Offices: 74-16 Grand Ave., Maspeth (N.Y.C.), N.Y., DEfender 5-8000.





#### ELECTRIC TUBE PRODUCTS

74-16 Grand Avenue Maspeth (N.Y.C.), N.Y. Diffender 5-8000



ment. Bi-directional positioning is affected by polarized dc signals transmitted from a supervisory control panel to a remote slave receiver. Quantitative data on the controlled function is transmitted from the slave unit back to a meter on the supervisory panel. Visible and audible alarm, as well as fail-safe, lock-out, and hold-out features, can be added for complete supervision of the remote equipment. Control systems are available with or without transducers for telemetering a wide variety of functions, and with pilot operators up to several hp rating.

Sparton Control Systems Div., The Sparks-Withington Co., Jackson, Mich.



Lighting Fixture

A new lighting fixture, called the "Spacelighter", has been designed for easy installation. The unit is designed for use in grid ceilings and has two handles attached to it to enable the installer to lift it into place quickly and easily. Other parts also assure ease of handling. Plastic diffuser panels, crossbar closures, and reflectors all simply snap into place. Where it is necessary to use studs and nuts, the nuts are captive so they are a part of the fixture and cannot be dropped or lost. On many jobs, one man can do the work of two in fixture installations. Appearance and lighting efficiency are also carefully engineered in these fixtures.

Leadlight Company, 800 100 St., Oakland, Calif.

#### Air Handling Units (39)

A new line of air handling combination units for general applications including ventilating, heating and air conditioning. Designated as series 1600, they are available in 13 basic sizes capable of handling 500 to 48,500 cfm. Constant air flow is assured by deep, closely spaced, forwardly curved blades. Designed for minimum space requirements, all the unit components are easily accessible, facilitating inspection, lubrication and filter changing. The complete line features stand-



ard blast and steam distributing coils, direct expansion and water heating and cooling coils.

Westinghouse Electric Corp., Sturtevant Div., Dept. 151, Hyde Park, Boston 36, Mass.



Spacer

A new one-piece "Between-Poles" spacer for vertical secondary circuits and "mid-span" service taps. This spacer supplies a method of providing greater distance between poles that carry live, uninsulated vertical conductors and also permits installing of service drops without erection of poles. It is molded in one piece of resilient acrylic resin. Conductors are installed in the spacer's hooks by means of "snap-in, lock-in" resilient triggers. Heavy galvanized steel wire halves of the bails spring-lock each other in place. Double construction of bails allows service taps to be made on either or both sides. Maximum conductor diameters accommodated are .580 in. Literature is available.

(40)

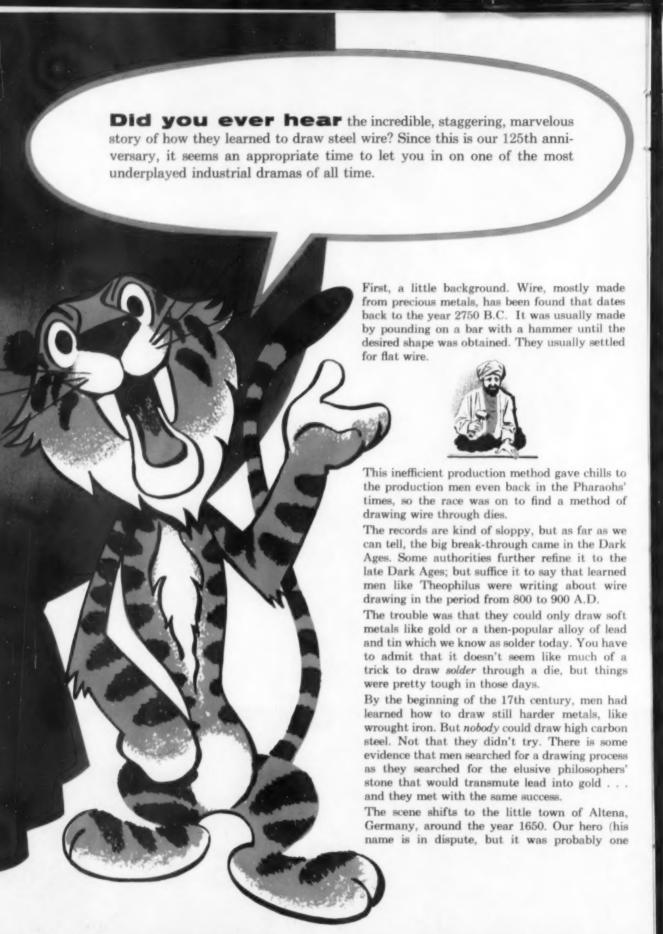
Hendrix Wire & Cable Corp., 19 Watson St., Boston 18, Mass.

#### Downlights (41)

A new series of incandescent downlights has been announced. These 500-watt open reflector units are highly efficient for general illumination in rooms with high ceilings, either flat



AT LAST! An excuse to tell our favorite story!





Johann Gerdes) had tried all sorts of wire drawing tricks. He used dozens of different die lubricants, weird types of dies, slow pulling, fast pulling, high and low temperatures. Nothing worked, so you can hardly blame him for picking up the bundle of steel rods and marching outside with them. There, he flung open the door of what might be loosely called the gents' rest room, and dumped the rods down the hatch.

Some time later, they needed more rods for the experiment, so a few hardy souls retrieved the ones that had been banished in such a dramatic manner. The rods were carried back into the little factory and they drew beautifully—the first drawn high carbon steel wire. Some profound change had taken place in the steel. They didn't know what had happened, but they liked the results.



A thriving industry grew up in Altena. And they say it was quite a sight to see the workers come in of a morning with a yoke pole across their backs, supporting a lunch bucket at one end and a common household utensil at the other—the raw materials for a day at the wire mill.

Altena enjoyed a complete monopoly on steel wire drawing for almost a century, until an obviously disgruntled worker found that dilute sour beer would also do the job. Finally, some kill-joy discovered that you could even use water if you did it right. The "secret" spread, and from then on, Altena had to bask in her rather impressive past glory.



On this 125th anniversary, we think we are entitled to mention that American Steel & Wire is a highly reputable organization employing about 30,000 devoted workers who really know how to do things to wire. The original company was

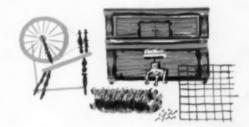
formed in 1831 by two live-wire gentlemen named Ichabod Washburn and Benjamin Goddard, who, if they lived in this wonderful generation, would probably own half of the United States and Canada. Brilliant as these gentlemen were, the company never really started to roll until ladies became interested in hoop skirts, because this was the first true volume market for wire!



After the Civil War, the hoop skirt market went to pieces (you know how women are about fashion), and things looked pretty gloomy until barbed wire was invented around 1870. It's been one thing after another right up to the present time.

As the most knowledgeable wire maker in the USA, it was rather natural for us to begin making electrical wire and cable right at the beginning—1891 to be exact. Our salesmen frequently stumble across Tiger Brand electrical cable that has been buried in the ground or under water for 30 to 40 years and is still giving good service.

When we discuss incidents like this at our frequent sales meetings, the general comment is that our high production standards certainly don't help our replacement market very much, but fortunately, we're part of a great and growing industry. And, what with nuclear power plants and the like, there will always be a big demand for Tiger Brand Electrical Wire and Cable from buyers who want that extra margin of quality that we learned to build into our products a long, long time ago.





#### A brief summary of Tiger Brand Electrical Wire & Cable



TIGER BRAND

Premium quality cable for high voltage use. Lead sheaths are applied under high pressure to insure dense surface. Lead tanks are kept under inert atmosphere to prevent formation of impurities. All constructions available, including type GN glass, neoprene fabric jackets.



ASBESTOS

On these cables, we do *not* apply the asbestos as a twisted yarn, because the yarn will frequently open when the cable is kinked. Tiger Brand cables feature asbestos that is combed and carded, then applied as a true felt which is compressed tightly around the conductor.



TIGER BRAND VARNISHED CAMBRIC CABLE This is the great "in-between" insulation, for use where you want greater moisture resistance than paper has, and higher voltage ratings than offered by rubber insulations. In dry locations, varnished cambric can be used without a lead sheath, because it is not subject to oil drainage.



TIGER BRAND

Features rubber insulation and a neoprene sheath. A versatile cable—with heavy jackets—it can be buried directly in the earth. It is perfect for conduit wiring when supplied with a thin sheath. When several RR cables are combined with a bare messenger, you have a self-supporting aerial cable.



TIGER BRAND

The very highest quality in heavy-duty portable cords and cables. All jackets are vulcanized in a lead sheath, and are permanently marked with molded identifications. High neoprene jackets show phenomenal resistance to abuse, sunlight, grease, oil or acid mine water.



TIGER BRAND SUBMARINE CABLE Many Tiger Brand submarine cables are still in service after 30 or more years. Heavy galvanized steel armor wires are applied with long lay to resist tensile stress. AS&W pioneered in construction of aluminum armor for salt water use.



TIGER BRAND INTERLOCKED ARMOR CABLE Available up to four-inch core diameter, with armor of steel or aluminum. Eliminates costly conduit bending and fitting. Splices can be made anywhere along the cable's length. A great money saver for plant wiring installations, especially in cramped quarters.



TIGER BRAND ELEVATOR CABLE Cables are carefully designed to have just the right degree of flexibility so they will bend easily at the bottom of the shaft, but not so sharply that the wires will be deformed. We also supply a complete range of annunciator, lighting and signal cable, plus hatch wire for elevator shafts.



A Standard Tiger Brand Cable for every special job

AMERICAN STEEL & WIRE DIVISION • UNITED STATES STEEL

**USS Tiger Brand Electrical Wire & Cable** 



or sloped. The specially designed Alzak reflector works with the reflector lamp to give maximum light output with a minimum of surface brightness at viewing angles of less than 45° from the horizontal. The units are recommended for large public places-banks, churches, auditoriums, terminals, theatres, etc. The units have an efficiency of 82%, with all of the brightness contained in a 90° cone of light. Outside of a 45° viewing angle, there is no brightness or glare. Units are designed for top and bottom access, are available with "gold glow" and "perfection pink" reflectors.

Century Lighting, Inc., 521 West 43 St., New York 36, N. Y.



Winder (42)

A new fish tape winder, called "Tape-Mate", fits completely around the reel. It is assembled with four screws. When holding the reel, the Tape-Mate is pushed forward to wind or pulled back to pay out tape. It fits the hand and glides around the fish tape reel. It fits all "Hi" 12-in. fish tape reels or equivalent containing in flat fish tape.

Holub Industries, Inc., Sycamore, Ill.

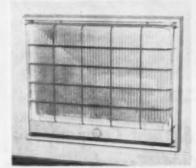
#### Lighting Unit (43)

A new fluorescent lighting unit, called the Capri. It is 3 in. high by 10 in. wide, and comes in 48- and 96-in. lengths for individual or continuous line installation. Unit is designed for two 40-watt rapid start or 96-in. slimline lamps. Special newly-designed sliding hangers are available so that units may be mounted under pipes or duct work. A vent, which runs the length of the unit along the bottom, circulates air through unit. Diffusing panels are of polystyrene



plastic. For cleaning, panels are lifted out of unit chassis, then slipped back into position. For use in schoolrooms, stores, offices and other commercial interiors.

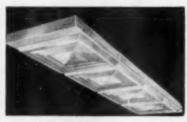
Benjamin Electric Mfg. Co., Des Plaines, Ill.



#### Heating Panels and Cables (44

A complete line of glass radiant heating panels and ceiling cable has been announced. The line of ceiling cable includes wattages from 400 to 4400 for various lengths of the nylon jacketed cable which is UL approved for either dry wall or plaster construction. This cable and the line of glass panels, ranging in size from 450 to 1500 watts, are available with line voltage thermostats which can handle up to 5000 watts. Both surface and recessed models of panel are available, including a ceiling panel, for new construction and remodeling installations.

Dixie Raydiant Electric Heat Corp., 66 11th St., N. E., Atlanta, Ga.



Fluorescent Diffuser

New ventilated fluorescent diffuser in the Cadillite series of flush-mounting rectilinear modules. Fixture features ballasts housed in air-cooled chambers at ends of fixtures, yielding greater lumen output, permitting an

(45)



Contractors Told Us What They Needed . . . We Designed these boxes . . . Now They're In Our Standard Line Doing A Terrific Jobl

#### BEVEL CORNER SWITCH BOX

21/4"Deep, Non-Gangable

Nation type with notches indicating mounting depth. Available with plaster sers and various types of mounting brackets. Clamps can be mounted with scraw through bevel on back.



Cat. No. 160-NG



Arrelet products have het-dipped galvanized finish, many times heavier than U.L. & Federal specifications.

When you have an installation problem not covered by our standard line, our engineers will design special units to your specifications.

Write for Our How Catalog.



Sales Representatives & "Warehouse Stocks BALTIMORE, MD. • CHARLOTTE, M.C. • "CHICAGO, ILL. • "CINCINNATI, OHIO • DENVER, COLO. • "LOS ANGELES, CALIF. • "MIAMI, FLA. • NEW YORK, M.Y. • NEWTON CENTRE, MASS. • "PHILADELPHIA, PA. • ROCHESTER, M.Y.



Jersey Central Power & Light Co., South Amboy, N. J. Burns & Roe, Engineers.
The Cape Cable Trough shown above carries as much cable as all of adjacent system.

#### Jersey Central Power & Light Company Cuts Costs with Cable Trough

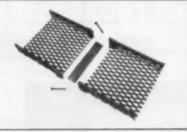
The great space saving possible with Cope Trough is dramatically illustrated at Jersey Central Power & Light Company's South Amboy installation of cable supports. Where space is at a premium, specify Cope Cable Trough.

**SAVE LABOR** during installation. Cope Cable Trough with the exclusive Pin-Type Coupler goes in faster than any other trough system. Standard fittings are available for virtually any connection, corner, awkward space—yet fewer individual pieces are needed and installation time is greatly reduced.

SAVE MATERIALS with Cope Cable Trough. You support far more cable with the same weight of Trough than with any competing system—and steel is costly.

EXCLUSIVE COPE PIN-TYPE COU-

PLER greatly simplifies installations, reduces installation costs, and provides greater adaptability. Pin is driven into interlocking barrels and rigidly secures the connections. Bottom plate protects cable at Trough connections.



Our engineers are ready to work with you. Write us today for full details on new 70,000 Series.

T. J. COPE, INC

COLLEGEVILLE 5, PENNSYLVANIA













extremely shallow case, and resulting in 3-lamp models in addition to 2- and 4-lamp series. Luminous side panels in a totally enclosed modular diffuser, spreads light into ceilings. The line includes 2-, 3- and 4-lamp models for 48-in. rapid start lamps; and 2-, 3- and 4-lamp slimline models for 48-, 72-, and 96-in. lamps. All Cadillite fixtures may be flush mounted individually or end-to-end on any ceiling. Catalog is available.

Peerless Electric Co., 576 Folsom, San Francisco, Calif.



Runway Marker Lights

(46)

The bi-directional beams of a new high intensity runway marker light can be aimed or brightened by remote control to meet any kind of weather conditions along an instrument landing runway. By means of a control panel, (Type CPT) located in the control tower, tower operators can handle a whole system of the new runway marker lights by switching them off or on, raising or lowering their brightness and aiming them in accordance with the control panel's indicator scale which is calibrated in degrees of weather visibility.

Type HRC is equipped with a double prismatic lens system, which houses a 500-watt, 115-volt prefocus type lamp.

The light will withstand static loads from high winds or propeller blasts but can be sheared at its base by light impact when struck horizontally. Only two wires are connected to each fixture, one "hot" conductor and one neutral, and are joined together at the break point of the breakable coupling by a plug and receptacle connector.

To service such a lighting system, a 2400-volt circuit is run from a transformer vault to underground manholes installed along the runways, with one manhole for each eight or nine fixtures. A manhole is equipped with a 5 kva distribution transformer from which a 240/120-volt power circuit is run to the lights. One runway requires anywhere from eight to ten manholes.

Crouse-Hinds Company, Wolf & Seventh North Sts., Syracuse, N. Y.



**Pipe Tool Unit** 

(47)

"Pipe Shop on Wheels" combines the No. 20 Beaver "Speed-Cut" abrasive cutting machine and the newly remodeled Model-A pipe and bolt machine on a pneumatic-tired trailer. Unit can be hauled by car, truck or jeep right to the work site. No. 20 abrasive cutting head is powered with a 8.3 hp Wisconsin gas engine or with a 5, 71 or 10 hp 220/440-volt, 60-cycle, 3-phase motor. Pipe and bolt machine is powered with a 110 or 220-volt Universal single phase 25 to 60 cycle motor; a 220/440-volt, 3-phase, 60 cycle motor or a 2500-watt dc generator with extra outlets for small electric tools. Cutting machine has a cutting capacity up to 6-in. pipe or shapes; 21-in. solid stock. Pipe and bolt machine has a capacity from 1-in. to 2-in. pipe; 1-in. to 2-in. bolts. Up to 12-in. with a drive shaft which operates geared pipe cutters and threaders.

Beaver Pipe Tools, Inc., Warren, Ohio

#### **Product Briefs**

(48) Multi-purpose long wave ultraviolet radiation source for chromatography, laboratory research, inspection and medical observation has been put on the market by Black Light Corporation of America, San Gabriel, Calif. It is called the Blak-Ray Model . . . (49) Laramie Chemical Corp., Stamford, Conn., has introduced a new fire alarm, called "Fire Spy", that is installed by plugging into any standard ac outlet. . . . (50) A low cost glass-mat polyester plastic insulation is available in flexible form suitable for bending around corners or wrapping in cylindrical forms. It is known as Glastic "Grade FM" and is manufactured by the Glastic Corp., Cleveland 21, Ohio.

(51) Georator Corp., Manassas, Va., has introduced an improved version of the "Nobrush" alternator in ratings up to 750 va, 3-phase. . . . (52) A new line of Axiflo Fans, designated as Series 300, has been announced by Westinghouse Electric Corp., Sturtevant Div., Boston, Mass. . . . (53) Nutone, Inc., Cincinnati, Ohio, has introduced door chimes with chord tones, available in two models, L-30 and K-41 C "Symphonic".

(54) A new expansion drive rivet for fastening to masonry has been de-



with Fewer Poles!

New Peres 4 In 1 Spectacular

for large area illumination



Important Advantages of the

Ultra-lité

LUMINAIRE...

- \* A truly scientific and effective application of mercury luminaires producing a square light pattern
- Provides abundant light for both vertical and horizontal surfaces
- \* Achieves more light with fewer poles and fixtures
- ★ Gives the lighted area new impetus in attracting more trade
- \* Reduces maintenance and repair costs



TYPICAL INSTALLATION



Mounts on Revere 30 foot Octogonal Rigid Poles or Revere No. 199-0830 Hinged Pole. The Hinged Pole permits easy cleaning and maintenance without expensive elevator equipment. Revere Ultra-Lites with their 52 inch spherical dome and four Mercury Luminaires offer an entirely new concept for large area lighting. They provide wider coverage, better vision and high efficiency coupled with a modern, distinctive appearance which makes them the most logical units for lighting of Shopping Centers and Parking Lots—Play Grounds—Amusement Centers—Beaches—Drive-ins, etc.

Write today for descriptive literature.

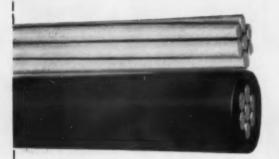
REVERE ELECTRIC MFG. CO. • 6009-17 BROADWAY • CHICAGO 40, ILL.

Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

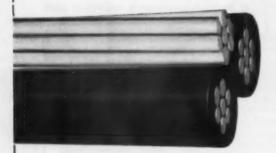
THE ONLY COMPLETE LINE OF CUMINAIRES - PLOCOLIGHTS AND POLES FOR STREET - SPORTS AIRPORT - SERVICE STATION - OUTDOOR THEATRE - MARINE AND INDUSTRIAL LIGHTING



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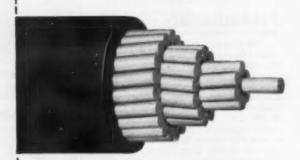




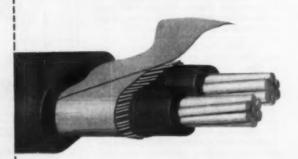
ASCR . ALL-ALUMINUM . AAAC



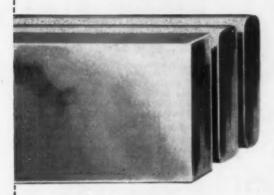
ARMORED SERVICE DROP



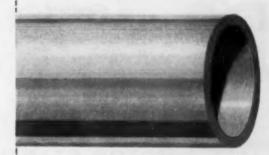
BUILDING WIRE



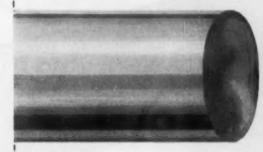
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Whenever you repair a capacitor-start motor, where electrical damage has occurred, replace the capacitor as part of the job. It takes only a little effort—doesn't cost much—and you assure maximum starting torque for your repaired motor.

Always replace with a genuine Wagner Capacitor—then you know you'll get top performance. The capacitor number tells exactly which capacitor to use. You're sure of the size—the mounting brackets—the terminals—and most important, the quality.

#### It's wise to stock Wagner Replacement Motors

Smart motor repairmen always carry a stock of Wagner Replacement Motors. They come in handy for emergency use when your customer needs immediate service and they're easy to sell as replacements for motors "too far gone" for repairs. You can get an attractive motor display rack for only \$9.95 with the purchase of ten or more Wagner Motors. Check into this deal today.

veloped by the Southco Division, South Chester Corp., Lester, Pa.... (55) An electro-pneumatic controller, used for measurement and control of current to ac motors or other ac circuits, has been announced by Hagan Corp., Pittsburgh, Pa.... (56) A new ribbon element Type EJ-2 current limiting fuse for motor starter application is now being produced by General Electric Co.'s High Voltage Switchgear Department, Philadelphia, Pa.

(57) Omark Industries, Portland, Ore., has developed a new hand tool which drives "Nails" into concrete with a hammer. . . . (58) A portable drilling rig, designed primarily for use on building and maintenance projects, has been announced by the Equipment Corporation of America, Cleveland, Ohio. . . . (59) Bentley, Harris Manufacturing Co., Conshohocken, Pa., has announced a new line of lacing tapes for wire harnessings and windings known as Ben Har Braided Tapes.

(60) Hilti Rapid Fastening Systems, Inc., 55 Van St., New York 13, N. Y., has developed a new drive tool for use in steel, concrete, brick and other suitable materials.

(61) Burndy Engineering Company, Norwalk, Conn., has added to its Linkit line sizes for 2/0 through 4/0 copper, aluminum, and ACSR. They had extended the range of Linkits, already available for service entrance conductors from No. 8 through 1/0. . . . (62) New service mast fitting combines roof plate and flashing and is available from M. & W. Electric Mfg. Co., Inc., East Palestine, Ohio. . . . (63) Plaster-Eye Company, Pittsburgh, Pa., has developed a new compact and sensitive detecting instrument, called Electronic Locator, which locates outlets in conventional wiring that have become plastered over.

(64) Texas Apparatus Co., Houston, Texas, has developed a new fluorescent fixture support, known as the Taco "Chanel" fixture hanger... (65) A new cord reel, called the "Handyreel, is designed for home, workshop and farm use. It is manufactured by Lakeshore Products, Woodinville, Wash... (66) A new drill hammer, which converts a standard ½-in. electric drill into an electric hammer for drilling holes in masonry, is offered by Rawlplug Co., New Rochelle, N. Y.

(67) Three major developments in the design of 3-way light bulbs, which will permit refashioning and streamlining of portable lamps, have been announced by Westinghouse Electric Corp., Bloomfield, N. J.



## CATALOGS and BULLETINS

(68) LIGHTING. Technical Data Folio 56-6, 8 pages, presents charts, tables and formulas required for design of illuminating systems. Coefficients of utilization for typical luminaires are included. McPhilben Lighting Co.

(69) UNDERFLOOR RACEWAY SYSTEMS. Dimensions, fittings and design features of Walkerduct, Flushduct, Power Raceway for industrial plants, and Headerduct for all cellular steel floors are provided in 8-page Bulletin 756. Service fittings for use with duct systems are detailed in Bulletin 656, 4 pages. Walker Brothers.

(70) FHP MOTORS. Characteristics and performance ranges of complete line are combined in a Motor Selector Chart. Howard Industries, Inc.

(71) ASBESTOS TAPE. Prevention of damage to cables by failure of adjacent primary cable is achieved by new technique of wrapping asbestos tape. 4-page booklet. Irvington Div., Minnesota Mining & Mfg. Co.

(72) SELF-LOCKING FASTENERS feature nylon plug imbedded permanently in threaded section, eliminating need for lock washers or other locking device. Bolts, nuts and screws are listed in 12-page catalog 11B. Nylok Corp.

(73) INSULATION. Pocket-size slide rule compares properties and costs of Mylar polyester film with eight other standard materials. Du Pont Film Dept.

(74) Motors. All-Weather line in ratings through 15 hp are available with a variety of operating characteristics. The special design features of these single-phase, capacitor-start units are described in 4-page Bulletin 470-A. Robbins & Myers Motor Div.

(76) CHURCH LUMINAIRES of both modern and traditional design are included in 8-page bulletin G along with photographs of installations and illustrations of other applicable lighting units. Accompanying spec

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Our high quality standards and sixty years of experience in the communication field assures dependability in our systems. The simplicity of design makes for ease of installation — savings for you.

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The U.S. E. Multi-Dlameter is cast In one piece with radial slots running from the collar to the end of the anchor on opposite sides, thereby splitting the anohor in two halves. These two halves are made with a tapered, rectangular hole through which the wood screw is turned, cutting its own threads. As the screw advances, it not only splits the two halves apart but also tends to shift and spread them sideways in opposite directions, making 4 points of pressure contact instead of the usual two.

#### THE RESULT IS TWICE THE HOLDING POWER OF OR-DINARY WOOD SCREW AN-CHORS.

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YORK, PA. DEPT. ECM-9

sheet gives all required selection and layout information. Pittsburgh Reflector Co.

- (77) PLASTIC COUPLINGS for use with Transite ducts offer time- and money-saving advantages. Methods of positioning and installing conduit made possible by the couplings are illustrated in 4-page Folder EL-78A. Johns-Manville.
- (78) CONDUIT BENDERS, designated the Chicago line are described in Bulletin 556, 4 pages. Calibrated degree scale simplifies production of accurate repeat bends. Gustave Lidseen, Inc.
- (79) BALANCER enabling in-place analysis and correction of unbalance is named the Vibrodyne. Portable unit may be used on equipment operating between 225 and 3600 rpm. Bulletin 53, 12 pages. Tinius Olsen Testing Machine Co.
- (80) OUTDOOR LIGHTING. Two bulletins. GEA-6438, 12 pages, covers practical aspects and characteristics of equipment used for parking area illumination as well as other commercial locations. GEA-6437, 8 pages, illustrates various techniques of architectural floodlighting and discusses problems involved in vertical surface illumination. General Electric Co.
- (81) CABLE AND WIRE. A 6-page folder entitled "The Four Minute Tour" gives an illustrated excursion through the various stages of production. Continental Wire Corp.
- (82) LIGHTING PANELS. Three bulletins. L-110-H, 6 pages gives data on Alba-Lite panels in pattern number 55, 66, 93 and 99; low brightness panel—pattern 70—is covered in L-110-A, also 6 pages; and Bulletin L-110-C describes the new pattern 83 Crysta-lite panels for troffers. Corning Glass Works.
- (83) GROUND RODS. Complete line of Copperweld rods and clamps are detailed in 4-page Bulletin P-656. Hubbard and Co.
- (84) LUMINAIRE featuring 3-sided Holophane Controlens of acrylic plastic is named the Holiday. Available in 4- and 8-ft units for two rows of 48-in. Rapid-Start lamps. Dimensions and photometric data are given in 4-page Form D-660. Day-Brite Lighting Inc.
- (85) COIL WINDER designated the Mid Jet employs unique winding method permitting winding of coils having inside diameters of 3/32 of an inch. Electro Devices Co., Inc.

- (86) ELECTRIC HEATERS for industrial applications are catalogued in 30-page 27-620. Details of all styles are presented along with data on controls, selection and design procedures. Westinghouse Electric Corp.
- (87) Wiring Devices for weatherproof installations are available with either snap- or screw-cover. Form 556, 4 pages. Bell Electric Co.
- (88) MAINTENANCE TOWER retracts to 7 ft to clear doors, raises to 17 ft in 25 seconds. Electrohydraulic Moto-Lift is a one-man unit affording substantial labor savings through elimination of the floor man. Safway Steel Products, Inc.
- (89) METERING DEVICES. Two bulletins. Complete line of megohmmeters is described in 4-page 1248 while Bulletin 1046 covers five styles of tachometers. Herman H. Sticht Co., Inc.
- (90) Hospital Signal Systems combining audio and visual features reduce nurses' walking time as much as 63%, permitting more efficient use of time and better patient care. Components, applications and operation are described in 12-page booklet. Executone, Inc.
- (91) LOAD-CENTER TRANSFORMERS for indoor and outdoor installations are detailed in 12-page Bulletin CS-1000 covering technical data, design features and applications. Kuhlman Electric Co.
- (92) Power Regulation. Two bulletins. GED-2987, 12 pages, covers operation and applications of voltage stabilizing transformers in ratings to 10 kva. High frequency—500 to 12,000 cps—capacitors for induction heating equipments are described in 4-page Bulletin GEC-1346A. General Electric Co.
- (93) MOTOR INSULATIONS, including slot insulations, wedges and fabricated parts, are listed in 20-page Catalog 19. Dimensions, selection and ordering data are provided. Insulation Mfrs. Corp.
- (94) LIGHTING FIXTURES, fans, range hoods and door chimes are among the 912 items presented in this new 72-page catalog which includes products of the recently acquired Marco Division. Progress Mfg. Co., Inc.
- (95) INDUSTRIAL FLOURESCENT LUMINAIRES offering either 100% or 90% downlighting are described in 4-page Form 510F. Heavy-duty

Turreter units are available in 2and 3-lamp units for slimline and Rapid-Start lamps. Smitheraft Lighting Division.

(96) CONTROLS for air conditioning and refrigeration motors are available in 20-, 30-, 35-, and 50-ampratings in 2- to 4-pole sizes. Contactors are detailed in 8-page bulletin 5610. Furnas Electric Co.

(97) METERS AND INSTRUMENTS. Technical Manual 17, 87 pages, includes a comprehensive listing of 800 kinds and sizes of panel meters with descriptive material on design and performance; also a large section on electronic test equipment for a wide range of applications. Simpson Electric Co.

(98) FLOODLIGHTING. New L-69A general purpose sports and outdoor area unit features high efficiency, low maintenance costs and optimum beam cp distribution. Bulletin GEA-6435, 12 pages, demonstrates suitable applications and includes a floodlight selection chart covering other types of floods. General Electric Co.

(99) DRY-TYPE TRANSFORMERS in sizes from .05 to 500 kva are listed in 4-page folder 100. Dimensions, construction features and ordering information on these single-phase equipments are included. Hevi-Duty Electric Co.

(100) SCHOOL LIGHTING PLAN details requirements in each type of schoolroom, includes sketches of creative lighting ideas for various areas. Another pamphlet, 4-page bulletin 456, describes new high lustre goldtint finish available with many fixture styles in the manufacturer's line. Art Metal Co.

(101) Transfer Switch employs two circuit breakers with motor-driven mechanical linkage to provide service transfer when required. Units may be wired in any of four ways to meet system protective needs. Trans-O-Matic bulletin, 4 pages, covers design, wiring and dimensions of 50- to 800-amp, 2- or 3-pole switches. Lake Shore Electric Corp.

(102) RESIDENTIAL LIGHTING. Latest additions to an extensive line of indoor and outdoor units are illustrated and detailed in 16-page Style Book Supplement. Lightolier, Inc.

(103) FIRE ALARM SYSTEMS. A 10-page guide to preparation of fire alarm specifications quotes NFPA code requirements and explains them in detail; various types of systems are also described. Edwards Co., Inc.



#### to Clinch the Business

When you're bidding on sound system specs for any construction, new or old, RCA gives you a competitive edge. Why? Because in selling and installing sound, the finest costs no more. And RCA is the best name for quality and dependability in electronics.

In addition to RCA quality, you sell RCA flexibility and RCA engineering. When you specify RCA sound, you can choose from a complete line of flexible, intermatched audio equipment. RCA engineering talent and manufacturing skill show in the year-after-year performances of every component. It's good to know, too, that nationwide service and replacement parts are readily available when needed.

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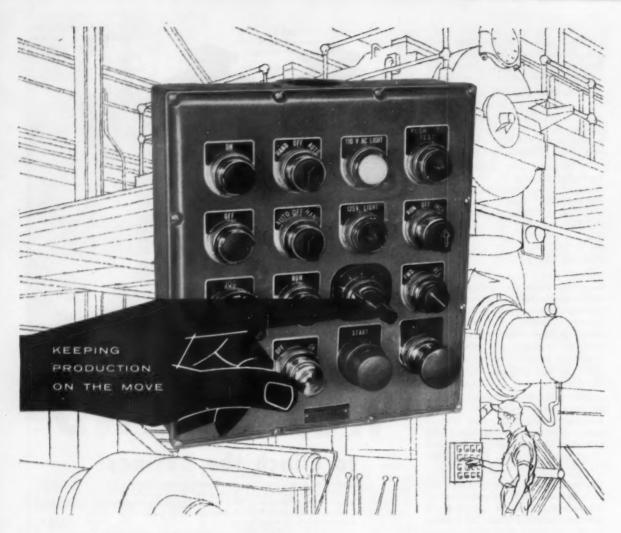
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Interchangeable parts — stations, contact blocks, operators and indicating lights — right off the shelf, quickly give you a "tailor-made" Westinghouse Oil-Tite\* control station to meet the requirements of any heavy-duty industrial equipment application.

Enclosures — die-cast and Bonderized — include cork-neoprene gasketing and close machine fits as positive seals against exposure to oil, coolants, 
\*Trade-Mark

cutting compounds, water and other foreign matter.

#### New Pushbutton Guide

For more facts on why it will pay you to standardize with Westinghouse control stations, get a free copy of the new Pushbutton Guide, booklet B-6749. See your nearby Westinghouse alesman or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30210



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## Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

#### Power Factor in Motor Circuit

QUESTION P30—Would the power factor within an induction motor be improved by installing an extra winding for each phase and connecting the extra winding across a capacitor? Would this be a better way than just improving the power factor of the wiring to the induction motor?—E.B.

ANSWER TO P30—The method of power factor improvement proposed involves a change in the motor that makes it special in its winding make-up, and if attempted ought to include some opinion from the manufacturer. The possibility of a patent infringement might also exist in the way the compensating winding is applied.

From a practical standpoint the application of a commercial type of capacitor at or near the motor would definitely improve the circuit power factor and its regulation without the need for changes in the motor winding and the possible complications involved.—C.O.D.

ANSWER TO P30-Yes, the power factor would be improved by this method, but it is a cumbersome and expensive way to do a simple job that can be done just as well by capacitors connected externally in parallel with the motor. Motors are designed to NEMA standards which do not allow any unnecessary space in the motor frame. This is desirable since motors should be as small as possible. Therefore there is no room in the motor for extra equipment such as capacitors. Also capacitors are subject to failure, and should be external for convenience of maintenance. The proper way to improve induction motor load power factor is to install 3-phase or single capacitors as near the load center as possible.-E.A.M.

#### Where to Apply PF Capacitors

QUESTION Q30—In choosing capacitors for a plant, would there be any advantage in having higher

voltage capacitors to serve the entire plant, or would it be advantageous to use the lower voltage type, so that they could be applied to the motors with low power factor?—E.S.H.

ANSWER TO Q30-Capacitors can correct circuit conditions only between themselves and the source of power. Is copper cross-section ample throughout the plant, and is the prime consideration a better billing rate? In this case, capacitors at the main substation would be sufficient. Is the problem largely voltage drop and circuit capacity between the main substation and one or more distribution centers? Capacitors at the distressed distribution centers will improve this situation and may help the billing situation also. If the real trouble is in the motor circuits, capacitors at the motors will better conditions all the way back to the utility connection. Installation economies, on the other hand, may dictate grouping of capacitors in such a way as to strike a compromise between cost and the benefits from 100% power factor improvement. In other words, give the most attention to points of real need and less to circuits which are giving good performance as they are.-L.E.B.

ANSWER TO Q30-The installation of a bank of capacitors to serve the entire plant will improve the power factor on the circuit supplying the plant, but will have no effect on that of the internal distribution system. The capacitor rating in this case will have to be based on some particular assumed load; under lighter or heavier loads the power factor will be over or under corrected. The user will be benefited by reduction of load on his service equipment and by reduction of power factor penalty charges if imposed.

If individual capacitors are applied to those motors which have low power factor, the previously mentioned benefits will be obtained and will extend to all parts of the system formerly affected by low power factor; load and heat losses of the wiring and transformers will be reduced and voltage regulation improved, permitting additional

load to be connected to the original wiring. As each capacitor will be disconnected when the motor to which it is applied is shut down, the connected capacitance will more closely conform to the requirements of the moment.—B.F.S.

ANSWER TO Q30-It does not make too much difference in cost per kvar whether low voltage or high voltage capacitors are used. Since the low voltage type must carry high current, they must have heavy current-carrying plates; the high voltage type takes low current but must have bulky insulation. Capacitors located near each load will lighten the load on plant wiring as well as improve power factor, while a centrally located capacitor bank would only improve the power factor without relieving feeder load.-E.A.M.

ANSWER TO Q30—Generally it is better to locate several capacitors at load centers throughout the plant, although the initial cost may be higher. This is most easily understood if the objections of low power factor are known.

Low power factor is undesirable because it represents current in the system that produces no useful work, yet must be allowed for in transformer and feeder capacity to prevent overloading. It is caused by the magnetizing current required by transformers, induction motors, fluorescent light ballasts, and similar equipment.

Under normal circumstances this magnetizing current is supplied by the utility, either from its generators or from capacitors on its system. When a plant installs capacitors it automatically begins to supply some of its own reactive current, and the load on the utility is reduced. If the power contract is based on kva or contains a power factor clause the monthly energy bill will be reduced.

Should the capacitors be installed near the service, the utility is relieved of the reactive current, but the plant system is not. While the plant generates its own magnetizing current, this current still flows in the plant feeders and transformers from the capacitor to the various low power factor loads.



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If, however, the capacitors are located near the loads, not only is the power bill reduced, but the plant feeders and transformers are also relieved of this unproductive current. Frequently this means an overloaded system can actually carry a larger load with no increase in capacity simply by the proper application of capacitors.—D.H.N.

#### Transformer Loading On Delta Hookup

QUESTION R30—If three 50 kva single phase transformers connected in delta are being used for power and we wish to connect a single phase 20 kva lighting load with a mid-tap on one of the phases, how is the load distributed over the three phases?—V.M.M.

ANSWER TO R30—Rather than having asked how "is" the load distributed over the three phases I believe you really mean how "can" the load be distributed over the three phases and yet not overload any transformer winding. This can be explained most easily by the diagram below.

First of all, the maximum theoretical capacity of the transformers will be 3x50 kva or 150 kva. This can be obtained only if the load is balanced, since any unbalanced load of 150 kva will cause at least one of the phases to supply more than 50 kva and become overloaded. Therefore, in order to obtain the best possible results and the maximum efficiency from this type of transformer connection, we should distribute the load as follows:

1) The 20-kva lighting load should be equally divided across one of the phases (say a b) and its center-tapped neutral conductor. This would mean 10 kva each from a and b to neutral, and is represented by A in the diagram.

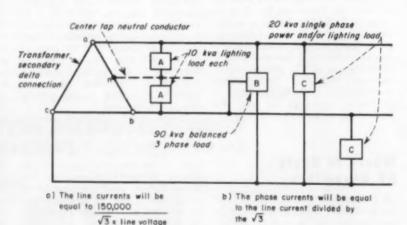
2) Since you wish to connect the three single-phase windings into a 3-phase delta combination, then I must assume you have some sort of 3-phase balanced load; and that the characteristics of this load make it necessary for you to connect the transformers as a delta hookup. Therefore, in order not to overload phase a b, (to which the 20 kva lighting load is already connected) you cannot add more than 30-kva additional load to it: or 3x30 kva = 90 kva as a balanced 3-phase load. This load is represented by B in the diagram.

3) Phase ab is now fully loaded. Phase b c and c a can each take an additional 20 kva, (single phase power and/or lighting load) in order to fully utilize the transformer to its maximum capacity.—I.N.

#### Transistors in Voltmeter

QUESTION S30—How can I make a burnout proof voltmeter by using transistors?—H.S.

ANSWER TO S30-To eliminate the effect and hazard of frequency variation on voltages measured, any very small rectifier could be used in conjunction with a dc voltmeter. The dc voltmeter would have to be calibrated correctly. All transistors are supposed to have a saturation effect. That is, current only increases up to saturation point. The saturation point would have to be below burnout point of voltmeter. The rating of transistor would have to be large enough to pass full scale voltmeter current through it before saturation point was reached.-E.B.



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without
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## Reduced Voltage Motor Starters



#### AUTOMATIC MULTIPOINT RESISTANCE TYPE

Meets power company starting current rules on network systems. Resistors are automatically inserted in the line at starting, and are short circuited in steps at definite time intervals which can be adjusted from 1 to 5 seconds.

BULLETIN 741



#### AUTOMATIC STEPLESS GRAPHITE RESISTOR TYPE

The ultimate in velvet smooth acceleration of squirrel cage motors. Lamp flicker on network systems used for both power and light is eliminated. The graphite disc resistors are compressed automatically . . . smoothly and steplessly.

BULLETIN 742



#### AUTOMATIC AUTOTRANSFORMER TYPE

Utilizes an autotransformer connected in open delta to reduce line voltage for starting squirrel cage motors. Taps are provided on the autotransformer to adjust the voltage applied to the motor.

BULLETIN 746

#### MANUAL STEPLESS RESISTANCE TYPE

Graphite compression disc resistors provide smooth, stepless starting of polyphase squirrel cage motors—prevent lamp flicker. Operated by a hand lever, the smooth starting of the motor is under the control of the operator.

BULLETIN 640



#### MANUAL AUTOTRANSFORMER TYPE

Recommended where the characteristics of the driven load or power company rules require reduced voltage starting. Double break, silver alloy contacts are standard for air-break starters...copper contacts for oil-immersed units.

BULLETIN 646



#### AUTOMATIC PART-WINDING TYPE

For use with squirrel cage motors having two separate parallel stator windings. Two types—Style A, two step starter; Style B, three step starter having resistance in series with motor on the first step.

BULLETIN 736

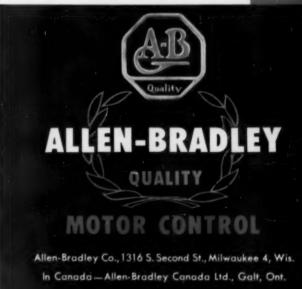


#### AUTOMATIC GRAPHITE RESISTOR TYPE

Graphite disc resistors are automatically inserted in series with the squirrel cage motor at starting. These resistors can be steplessly adjusted for motor and load conditions, resulting in remarkably smooth acceleration of the motor.

BULLETIN 740





# Installing instantaneously operated contact black with one N.O. and one N.C. contact

Bulletin 849 "On-Delay" timer. By inverting solenoid, timer is converted to "Off-Delay" operation.



Timer Adjustment

The timing interval can be adjusted quickly and easily by turning the adjusting screw.

## Tell Us About YOUR TIMER NEEDS . . . Allen-Bradley Has the RIGHT ANSWER!

Here is a line of pneumatic timers that can be adjusted for a consistent time delay of 1/6 second up to 3 minutes. Air, drawn into the timer through a needle valve, is freed from dirt and dust down to submicroscopic size by a high efficiency glass fiber paper filter. Thus the time settings are accurately maintained over long periods. These timers can be expected to operate reliably under conditions of severe atmospheric contamination.

An outstanding feature of these timers is the wide variety of types available, and the modifications which can be made in the field, such as adding one or two instantaneously operated auxillary contacts. Also, it is easy to change an "On-Delay" timer to the "Off-Delay" operation, or vice versa—by simply inverting the operating solenoid. The "On-Delay" timer provides the time delay after the magnetic operating COIL IS ENERGIZED; the "Off-Delay" timer provides the time delay after the operating COIL IS DE-ENERGIZED.

The Bulletin 849 timer has one normally open and one normally closed contact. As usual, the Allen-Bradley double break, silver alloy contacts are maintenance free. Auxiliary contacts can be mounted as shown below.

Bulletin 849 timer with one N.O. and one N.C. auxiliary contact.

#### A few typical Bulletin 849 Pneumatic Timer combinations



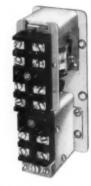
Bulletin 849 "Off-Delay" pneumatic timer with time delay after the coil is deenergized.



Bulletin 849 "Off-Delay" pneumatic timer with one N.O. and one N.C. auxiliary contact.



Bulletin 849 "On-Delay" pneumatic timer with two adjustable timing units.



Bulletin 849 pneumatic timer with two N.O. and two N.C. auxiliary contacts.

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PNEUMATIC TIMERS

In Canada— Allen-Bradley Canada Ltd. Galt, Ont.

#### Can You ANSWER These QUESTIONS?

QUESTION A31—Is there any way I can run a 5 hp, 3-phase, squirrel-cage induction motor on a single phase supply? If it will help, I also have an assortment of small single phase machines and polyphase machines.—H.M.

QUESTION B31—What would happen if a 3-phase short circuit was applied to the output leads of a 3-phase ac generator carrying load? The short circuit is applied at the output terminals of the generator. Would it stop, increase speed or remain the same as if it were carrying load?—J.B.K.

QUESTION C31-I have estimated the electrical work for several large warehouses recently and have noted in each case that the lighting is at 120/208-volts, 3-phase, 4-wire. The service is brought into the building at 13,800 volts to a unit substation. Here the transformation is to 277/ 480 volts, 3-phase, 4-wire. The power requirements are taken off at 480-volts. For the lighting, 480volt feeders are run to dry-type transformers located at the lighting panelboards and here the voltage is changed to 120/208 volts for the lighting system. Why is not 277/480 volts used for lighting (all code requirements for higher voltages are fulfilled)? In one installation alone there are 24 dry-type transformers costing \$10,000 which could be eliminated (with the exception of one or two required for 120-volt receptacles), also fewer panels would be required and smaller wire size could be used with a total possible savings of \$20,000 on one installation alone.

Even though the ballasts for the fixtures may be slightly higher priced for 277-volt operation, it seems to me that it is poor economics to use the lower voltage when the higher voltage is available, from the standpoint of initial investment and also from operating costs (IFR losses in the conductors). As three large warehouses designed by different engineers have used the lower voltage, it seems to be some other reason than economics that governs the voltage to be used.— F.D.

PLEASE SEND IN
YOUR ANSWERS BY OCTOBER 15

### BIDDLE Instrument News

#### Biddle Motor and Phase Rotation Tester (Dual Purpose)

With it you can . . .

- Determine the direction of rotation of electric motors before they are connected to the line.
- Determine the phase rotation or sequence of energized power circuits.



Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.

This device will permit the electrical contractor or industrial maintenance electrician to permanently connect and tape the terminals of the motor being installed, without having to first energize the motor by a temporary "hook-up" from a power source, if available, to determine its rotation.

Housed in a sturdy oak case 12¼" x 8½" x 4½" this compact unit weighs approximately 10 pounds and is supplied complete with 3 line and 3 motor leads which store in the compartments either side of the instrument panel.

For complete details write for Bulletin 80-ECM.

#### Biddle Dielectric Test Set Model 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter. §

Overall dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for Bulletin 22-ECM.

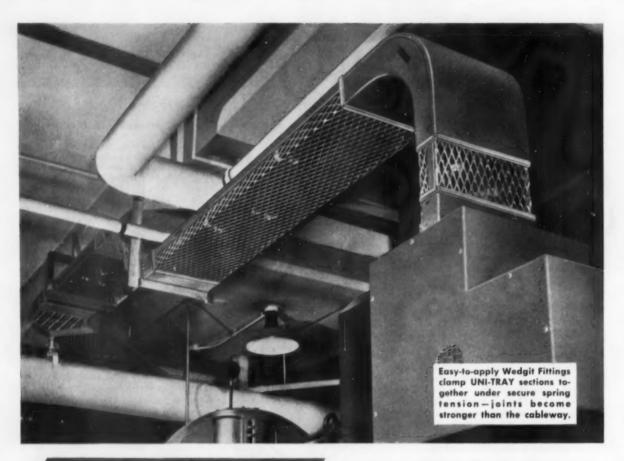


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## Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.
GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.
B. Z. SEGALL. Consulting Electrical Engineer, New Orleans, La.

#### Aircraft Hangar Wiring

Q. An owner of a private plane would like to have hangar wired for light and two electric blower type unit heaters.

Would installation have to conform to Section 5115, Class 1, Div. 2—all explosion-proof equipment and wiring methods?

Would RLM 60-in. direct light fluorescent 2/85-watt lamp industrial fixtures, or vapor-proof incandescent fixtures be permissible?

Installation to consist of ten lighting fixtures and two 5-kw heaters to eliminate the heavy moisture accumulation on plane due to inside-outside temperature differential when housed in hangar.

Hangar interior height from floor to ceiling 10 ft 8 in.

Concrete floor to top surface of plane wings 7 ft.

Hangar dimensions 18 ft by 41 ft by 10 ft 8 in.

Hangar is one of a number in a row of about six or seven. All hangars constructed of 8 in. by 12 in. cement block and wood roof.— E.Z.

The aircraft hangar you describe must comply with the requirements of Section 5115 of the N. E. Code. As shown by your diagram the entire area of each hangar is considered to be a Class 1—Div. 2 location up to a level of 18 in. above the floor, as covered by Section 5115-b-2. From the in-

formation submitted I do not believe there are any other hazardous areas within the building.

According to Section 5115-c any wiring or equipment which is installed or operated within the 18-in. hazardous area must comply with the provisions of Sections 5011 to 5026 inclusive. As an example, rigid metal conduit or threaded electrical metallic tubing must be used and according to Section 5105 seals must be installed where required. Switches must comply with 5106-b and lighting fixtures with Section 5019. It appears however that such provisions would not apply in the case presented since all wiring and equipment contemplated could be kept well above the 18-in. hazardous limit.

According to Section 5115-d-1 all fixed wiring in the hangar that is not located within the 18-in, hazardous area shall be installed in metallic raceways which includes Type MI cable.

In view of the 10-ft. 8-in. height of the hangar the fluorescent fixtures could not be located 10 ft above the wings and engine enclosures and therefore must comply with the provisions of Section 5115-e which requires the fixtures to be totally enclosed or provided with suitable guards or screens to prevent escape of sparks or hot metal particles. During the past year official interpretation No. 411 covered this Code provision as it applies to garages, and I believe the interpretation would apply to

hangars. It reads as follows:

"Section 5105 F: Use of Open Type Fixtures.

"Question: In an open-type of multi-story parking garage, the floors of which are classified as a hazardous area, may open-type fluorescent lamps without suitable guards or screens to prevent the escape of sparks or hot metal, be mounted less than 12 ft above the floor?

"Answer: No."

Section 5115-e also applies to the electric blower unit heaters. The motors and any other arc-producing devices must be totally enclosed or provided with suitable guards or screens to prevent escape of sparks or hot metal particles.—B.A.McD.

#### EMT for Underground Use

Q. Under protection for underground services EMT is listed for such use.

1. Is EMT approved for direct burial?

2. If EMT is approved for direct burial what is minimum depth?

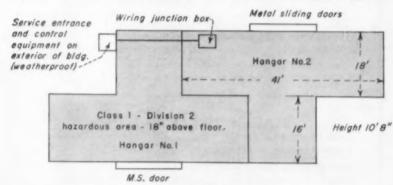
3. Would EMT as protection for direct burial cable across flower beds and up the side wall of the house be classed as subject to severe mechanical injury?—J.K.W.

A It should be noted that, in general, the requirements for EMT follow pretty closely those for conduit, with two possible exceptions,

1—the limitation where during installation or afterwards, the EMT will be subject to *severe* mechanical injury, and

2-the limitation for use in hazardous locations.

There is no definite statement that says neither conduit nor EMT may be buried directly in the ground, so the general inference is that both may be used for direct burial. The restrictions for cinder concrete or cinder fill in 3482-(2) and for corrosive locations in 3482-(4) and 3483 will of course have some bearing on this but will not prohibit the installation.



Class I - Division 2 Area, 18" above entire floor space, (shaded). Equipment above hazardous area, (5115-e).

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The only minimum depth stated in the Code is with reference to the relative location of the EMT beneath a cinder fill, viz., it shall be at least 18 in, beneath the fill, for use without 2-in. concrete envelope. As to any other depth requirement, the local code enforcing authority must rule on this for each specific job that comes to his attention. In general, any depth with a suitable protective covering, such as a heavy board, concrete cover, etc., would be acceptable. Without a protective covering or envelope, it would depend entirely on the type of occupancy and usage of the ground area. One area subject to a lot of digging or traffic may require a rather deep trench to keep the EMT out of the way of future digging, or to subject it to a minimum of crushing effect from the traffic. Eighteen inches to two feet has been found quite satisfactory but here again we cannot generalize since local conditions will rule. For example, if the area has a water line, or a gas line at a 24-in, level, it is reasonable to assume that future maintenance and operation work will require digging to this depth. The code-enforcing authority may want to require a 30-in. depth for the EMT under these conditions especially where the electrical system crosses or is adjacent to these other utility systems.

In my opinion, EMT would act as a protection for the direct burial cable in a flower bed, etc. The tools that are usually used in working up a flower bed and maintaining it would not subject it to severe mechanical injury.—B.Z.S.

#### Six Subdivisions of Service

Q. Is this a violation of the six main switch rule (2351a)?—J.W.H.

A. This installation seems to be entirely in accordance with Code requirements.

Section 2351 (and 2371) states "Each set of SERVICE-ENTRANCE CONDUCTORS . ." (emphasis by the writer), and the intent is to permit up to six for each separate set of service entrance conductors, not service, or service drop.

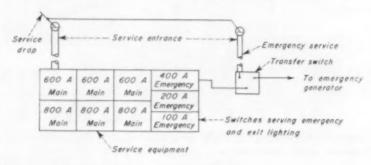
In the illustration shown, one set of service entrance conductors serves the three emergency services. A second set serves the six main circuits. We therefore comply with the six subdivision requirements.—B.Z.S.

#### Range Component Wiring

Q. In the installation of a 2piece range, should the cooking top and oven be separately protected by fuses or breakers, or is
it permissible to tie both to a common 50-amp supply in a junction
box?—J.H.D.

A. The question which you have raised has been the source of considerable controversy since the concept of splitting a range into components was first applied. During the past couple of years however it is required and generally accepted, in many parts of our country, that such components must be supplied from separate circuits.

In the 1955 edition of the Underwriters' Laboratories, Inc. Equipment List, page 188, the following statement is made: "Components of Ranges such as counter-insert surface-cooking unit assemblies, surface griddle units and wall-insert ovens intended to be installed separately in counter-tops, kitchen cabinets, or walls are covered under this classification (Ranges). These components are considered as individual units intended to be supplied from individual branch circuits. No spacing to adjacent combustible material is required unless specific dimensions are given in the individual listing in which



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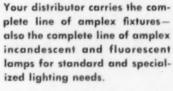


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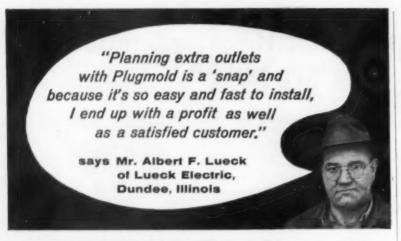
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in the individual listing in which case each device bears a diagram specifying these spacings. (See page 189 for illustration of spacings.)"

While the requirements of the Code may be vague in this respect, it is my opinion that separate circuits should be run to the oven and the cooking top.—B.A.McD.

#### **Exposed Wireway**

Article 362 Section 3622 says that wireways may be used only for exposed, dry locations. Would it be according to the code for a wireway to be installed above a removable ceiling that can be clipped on or off in 12-in, by 24-in. sections?—J.K.W.

A. It seems that we are dealing here with a matter of definitions. First off the code defines exposed (as applied to wiring methods): Accessible; not concealed.

Then—Accessible (as applied to wiring methods): Not permanently closed in by the structure or finish of the building; capable of being removed, without disturbing the building structure or finish. The definition for Concealed more or less reiterates this as follows:

Concealed: Rendered inaccessibleby the structure of finish of the

In your case the wireway may be made accessible since the building structure or finish is not actually disturbed. I would say such an installation would be permitted.

—B.Z.S.

#### Aluminum Wire Terminals

Q. Are the manufacturers of switches and panelboards doing anything about terminals in their equipment suitable for aluminum wire?—R.A.T.

A considerable amount of work has been done on this problem. Both the manufacturers of aluminum wires and wire terminals and connectors have done a great deal of research in an effort to develop proper terminals and proper procedures for terminating aluminum conductors.

The manufacturers of switches and panelboards, however, do not make, in general, any special reference to the use of aluminum wire with their products. Any installation requiring the use of aluminum

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### And it's the only glass panel with a one-year warranty

You can rely on the proven dependability of this low-temperature source panel to increase your electric home heat installations.

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You can recommend and install the Pyrex brand glass panel confidently.

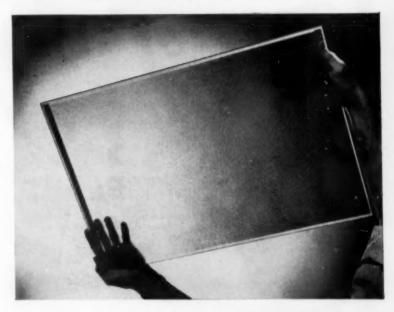
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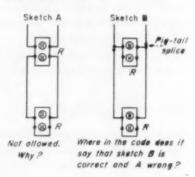
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wire with standard panelboards, switches, etc., should be specifically brought to the attention of the manufacturers of these panelboards, switches, etc., so that proper terminals will be provided.

In most cases different terminals are required. Larger and broader contact areas are needed. In some cases corrosion inhibitors should be applied.-B.Z.S.

#### Circuit Conductors Fed Through Receptacle Terminals

Many of the flush receptacles used in house wiring have four binding screws, two for neutral wires and two for the hot ones. When the wires are run from one receptacle to another, some inspectors will not allow you to feed through from binding screw to binding screw. They insist you use pig tails .- J.M.



I do not know of any Code A. provision which prohibits feeding the branch circuit conductors through the two terminals of a receptacle outlet, and it is my opinion that the two binding screws were provided for this purpose. Several years ago, receptacles only had one terminal per conductor and in those days the inspector prohibited the use of this single terminal to take care of more than one conductor. When the conductor was unbroken and looped through the single terminal it was acceptable to many inspectors. I personally do not believe there is any Code violation involved with the method shown by Sketch A .-B.A.McD.

#### **Special Ordinances**

Our city has outlawed the use of Type AC cable for several years, and allows only Type ACL cable. An adjoining oity has the opposite and outlaws Type ACL.

Is it your opinion that an inferior job is performed where the NEC allows Type AC and we are forced to use Type ACL.

Such practices seem very unethical—with the customer paying a premium for something which is not necessary.—A.K.A.

A • The situation you describe is quite prevalent—I am sorry to say. It is quite possible in some cases, that a municipality must have some special ordinance or law, to cover something special or peculiar to that locality. But in general, a great deal of thought should be given to any special requirements over and above those set up in the Code.

The Code does, after all, represent the best thinking of the vast majority of those interested in the general problems of the electrical industry. Now it is backed with over 60 years of experience, based on a continual national study of all electrical systems and equipment operating during that period. It would seem well for any local code authority to pause a bit and consider well before he pits his lone opinion against that of the thousands who have studied and worked to bring these various rules and regulations into the Code.-B.Z.S.

#### Computing Size Service Equipment—Continuous Loads

1—I plan to install a 3-phase, 4-wire, 200-amp service switch and find that 4 RH No. 250,000 conductors and 3-in. conduit is required. Is this correct?

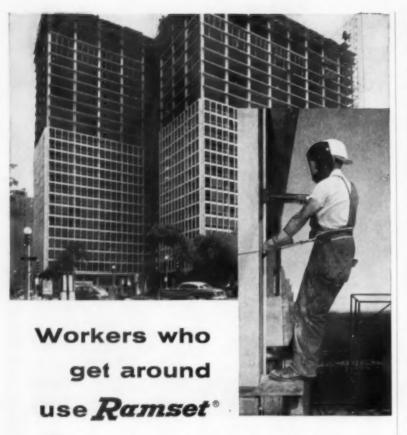
2—A fusible 200-amp. service switch is only good for 80% on continuous load or 160 amps. Consequently four RH No. 3/0 wire and 2½-in. conduit would be sufficient?

3—Because on a 4-wire, 3-phase system only three conductors carry current, the ground conductor does not carry, therefore four RH No. 2/0 conductors and 2-in. conduit would be required?—E.B.L.

A. In answer to your first question the size of the service entrance conductors required to serve a 200-amp service switch up to its rated capacity, operating on a 3-phase, 4-wire distribution system would be four No. 000 RH conductors. This combination re-



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quires a 2½-in. conduit. According to Table No. 1 a 250,000 cm conductor (Type RH) has a current-carrying capacity of 255 amps and since one of the conductors is a neutral conductor the 80% penalty does not apply. As a result the full 200-amp capacity of the No. 000 RH conductors may be realized.

In reply to your second question, Underwriters' Laboratories, require a service switch to be derated in line with the following:

"Service equipment consisting of a single, fused switch shall be marked, as a part of the electrical rating, Continuous Load Current not to exceed 80% of the rating of fuses employed in other than motor circuits."

Since the starting current of motors is recognized when figuring the size of the main fuse, it usually follows that the 80% factor for continuous operation would be satisfied by the size of fuse required to take the starting current of the largest motor involved. Assuming however that motor loads are not involved and that the 200amp switch serves a 200-amp load which is operated continuously and the switch contains 200-amp fuses. Under such conditions of operation the switch and fuse may not be loaded in excess of 80% of 200 amps which is 160 amps. This provision, in my opinion, in no way concerns the conductor current capacity and no reduction in wire size could be made. The distinction between intermittent and continuous loads concerns the heating effects on both the switch and the conductors that serve it. While the U. L. is particularly concerned with the switch rating, it also follows that similar consideration should be given to the conductors. During the past few years, air conditioning loads operating 24 hours a day over a period of weeks have proven the need for such recognition in both feeders and services.

In answer to your third question, the neutral conductor of a 3-phase, 4-wire wye system only carries the unbalanced current of the phases and there is no 80% penalty for four conductors in a conduit. This brings us back to question No. 1 which, as we have previously covered, required four No. 000 RH in 2½-in. conduit.

It is possible however, when 208volt motor loads are involved, that the neutral conductor may be decreased in size accordingly and a smaller size of conduit used. Theuse of a bare neutral also may result in a smaller size of conduit.— B.A.McD.

#### Further Comment on Fusing a 200-Amp Switch

Q. Regarding the question "Fusing a 200-amp switch," page 251 of the April, 1956 issue.

I wonder if an error was made in the answer that stated, a 200-amp fused switch for 4-wire, 3-phase can be wired with 4, RH No. 0 conductors in a 2-in. raceway, when No. 0 RH conductors are only good for 120 amp? According to the Code a 200-amp switch can be fused at 200-amp and requires four, RH No. 250 MCM conductors in 3-in. conduit, for a mixed lighting and motor load.—E.B.L.

A I do not believe there is any error in my previous comment on "Fusing a 200-amp Switch." The No. O RH conductors have a current-carrying capacity according to Table 1 of Chapter 10 of 150 amps. Four of these conductors are installed in a 2-in. conduit which is recognized by Table 4. Since one of the conductors of a 3-phase, 4-wire, wye system is a neutral conductor, the 80% penalty covered by Note No. 4, which follows Tables 1 and 2, does not apply. As a result the allowable current-carrying capacity is 150.

I am unable to find any Code provision which requires a 200- or a 400-amp service switch to be supplied by service conductors of

equal capacity.

As an example, the total computed load of an installation comes to 90 amps and includes a 3-phase 5-hp 208-volt motor. A No. 3 RH conductor is all the Code requires for the service entrance conductors supplying such a load. The starting current of the motor however requires a fuse capacity of slightly more than 100 amps. As a result a 200-amp switch and fuse must be used but the Code does not require the No. 3 RH conductors to be increased to No. 000.

The same reasoning applies when a computed load of 110 amps with no motor application is involved. The Code only requires 110 amps capacity in the service entrance conductors regardless of the 200-

amp switch size.

This comment is based solely on the minimum requirements of the N. E. Code and does not reflect my personal opinion in the matter. In these days of rapid development in our wiring industry I heartily endorse any effort which tends to promote adequacy, especially in service capacities.—B.A.McD.



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**Grounding Electric Clothes Dryer** 

Service entrance cable is permitted for use on dryer, with a bare neutral. Would NM with ground be permitted for wiring a clothes dryer?-J.R.W.

Yes. While Section 3382 A. refers specifically to the use of service entrance cable and permits the use of the uninsulated grounded conductor type under certain conditions stated, Section 2560 permits the connection of any approved wiring system's grounded circuit conductor to the electric clothes dryer frame provided,

1-the dryer is served by a 120/ 240-volt, 3-wire branch circuit (or larger), and

2-the grounded circuit conductor is a No. 10 AWG or larger.

These two requirements will insure the integrity of the ground system under most conditions of operation. By requiring at least a 3-wire branch circuit, we make sure that we are dealing with the more or less "all electric" type of dryer and not one that may depend upon a gas heating element for the major drying job and use electricity for only a small auxiliary fan. Secondly, the use of at least a No. 10 AWG grounded circuit conductor gives us a mechanically strong enough wire to withstand not only all normal mechanical usage to which it may be subjected but also to possible abnormal strains that may be imposed on it.-B.Z.S.

#### **Conductors in Multiple**

"Conductors . . . may be run in multiple provided they are of the same length. . . ."

Is there any allowance for these conductors being of different length? What percentage of variation is permitted, 1%, 5%, 10% or just how much? -S.T.

No there is no allowance for A. variation in length. From a practical standpoint it will be almost impossible to have these conductors installed in multiple so as to permit exact division of load current. We may comply with a very high degree of accuracy, with the requirements for equal length as set forth in 3105 and still have a considerable variation in current division between individual conductors.

The second sentence of Section

3105 points up the real problem in connecting conductors in multiple. The terminal connections of multiple cables may introduce sufficient resistance variations as to cause considerable variation in the current division between cables in any one phase of the multiple cable installation. It is, therefore, most important that we at least control those factors which are more easily controlled such as length, area and insulation and thus reduce the problem of current division to a single variable, i.e., terminal connections.

All other factors being equal the variation in length would cause a direct variation in current division. Thus a 1% length variation should cause a 1% variation in current. It has been pointed out that in many cases it is impossible to use equal length cables since the installation set up will not permit it. I have found, however, in practically every case where this objection has been brought up, it was possible to introduce oversize pull boxes, or larger junction boxes, or larger terminal cabinets to make room for the excess cable length that may be present because of the shortening effect the installation may have on some of the cable runs.

But to emphasize again the code requirement, there cannot be any length variation. The Code states simply and emphatically "Conductors... are of the same length..."
—B.Z.S.

#### Grounding Equipment to Circuit Conductor

As president of the Electrical Board of this City, I have been trying to convince the members of the importance of enforcing Article No. 4215 on grounding fixtures near grounded surfaces without success.

I would appreciate it very much if you could send me the following information:—

The purpose behind Article 2561, prohibiting use of the grounded circuit conductor for grounding equipment. How the use of recess metal wall boxes with bakelite surface plates would be considered under Article 4215. Also the use of non-conductive boxes. One of the objections given has been that in the past non-metallic cable with the third ground wire has been installed for use on 3-way switches. Please comment on this.—C.R.A.



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The question of grounding equipment to the grounded circuit conductor as now recognized by Section 2561 of the N. E. Code has been the subject of controversy for many years. There are many who believe that the present provisions for grounding range frames and clothes dryers to the grounded circuit conductor should be deleted and I doubt that the most ardent advocates of such a method of grounding would sponsor any Code provision which would permit the grounding of all types of equipment, portable or fixed, to the grounded circuit conductor.

This question is thoroughly covered in the January 1956 issue of the News Bulletin of the International Association of Electrical Inspectors by L. S. Inskip, who is Chairman of-Code Making Panel No. 5 of the National Electrical Code Committee. Mr. Inskip shows by wiring diagrams how the reversal of polarity or an open circuit in the grounded conductor will place a 120-volt potential on any equipment which is grounded to the circuit grounding conductor.

In residential and even small industrial or commercial occupancies the electrical wiring system often is subject to tampering by home mechanics who are not qualified by training or experience to do such work. Unless the mechanic clearly understands the principle of polarity and the significance of correct grounding, it may be readily seen how easy it would be to reverse the polarity of a system. A branch circuit may be connected to 10 or 12 outlet boxes and when switch loops are brought into such outlets we may have a white wire connected to a black wire. The trained mechanic understands why this is permitted but the untrained could easily make a mistake and connect the white wire which is energized to the metal outlet box. In an article of this nature it is impossible to cover all of the details involved and I suggest that you contact IAEI, 612 N. Michigan Ave., Chicago 11, Ill., for a copy of the January 1956 News Bulletin.

Section 4215 of the Code has proven by the fatalities which have resulted, over many years, its importance. The bathroom is an outstanding example of the life hazards which result when ungrounded electrical equipment is within reach of persons who are thoroughly grounded in a bathtub, in contact with plumbing fixtures or standing on a wet floor. Many fatalities have occurred in such locations when the provisions of this rule

have been discounted or disregarded. Members of any Electrical Board who discount the importance of this provision will, in the event of an accident, find themselves in a very difficult position, and if they are unable to justify their position with respect to Code requirements they may be liable for the resulting damages.

A bakelite plate on a metal box or a porcelain fixture attached to a metal box undoubtedly would not come within the scope of Section 4215. The fact remains however that a broken bakelite plate may be replaced with a metal plate, or the porcelain fixture may be replaced with a metal fixture, in either case, by persons who do not realize the hazards involved. As a result many inspection authorities require metal boxes to be grounded as covered by the general provisions of Section 2542. In the case of non-conductive boxes, the grounding rule does not apply. Here again however metal fixtures may be attached to same and a means of grounding such fixtures should be provided.

I believe we all realize that the bare grounding conductor of a non-metallic cable assembly may be used for circuit wiring by some who do not fully realize the hazards presented by such procedure. This of course is a direct violation of the Code and the person involved becomes responsible for any accident which may result therefrom. It is similar to other Code rules which are violated. When your Board accepts this or any other provision of the Code they do not assume the responsibility for a violation of the provision.

A summary of the foregoing indicates to me that someday you or your Board may be required to explain to a judge and jury your position with respect to Code rules. I believe your position will be very strong if you are able to show that you have at least sponsored the minimum requirements of a code, nationally recognized, sponsored by the National Fire Protection Association and approved by the American Standards Association.—B.A.McD.

#### Official NEC Interpretations

A new official interpretation and a new tentative interim amendment to the National Electrical Code have been released by the National Fire Protection Association. These are

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in addition to the official interpretations and amendments of the 1953 Code previously released.

Tentative Interim Amendment No. 105 introduces into the NEC the term "Dust-Ignition-Proof" as it may relate to electrical installations where arcs, sparks, or heat otherwise generated or liberated might cause ignition of nearby accumulations or atmospheric suspensions of a specified dust. This will be incorporated in the 1956 edition of the National Electrical Code, and will also be published by the NFPA in Volume V of the 1956 National Fire Codes.

Interpretation No. 432 deals with seals for raceways in aircraft hangar installations and applies to both the 1953 and 1956 NEC editions. Official texts follow:

TENTATIVE INTERIM AMENDMENT NO. 105 (Effective June 8, 1956)

Introducing the term "Dust-Ignition-Proof" into the text of Article 500 in appropriate Sections.

5051. General. Add a second paragraph to the 1953 edition of the National Electrical Code as follows:

"Dust-Ignition-Proof, as used in this Article, shall mean enclosed in a manner which will exclude ignitable amounts of dusts or amounts which might affect performance or rating and which, when installation and protection are in conformance with this Code, will not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure, to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure;" Also:

5054-a-1. After "shall be" in the eighth line, insert "dust-ignition-proof and;".

5055. Sealing, Class II, Divisions 1 and 2. Change first sentence to read "Where a raceway provides communication between an enclosure which is required to be dustignition-proof and one which is not, suitable means shall be provided to prevent the entrance of dust into the dust-ignition-proof enclosure through the raceway." (Remainder of paragraph to be unchanged.)

5056-a-1. Before "enclosures" in the last line, insert "dust-ignitionproof."

5057-a. Before "enclosures" in the fourth line, insert "dust-ignition-proof."

5057-b-3. Before "enclosures" in the second line, insert "dust-ignition-proof." 5058-a. After "approved" in the fifth line, insert "as dust-ignition-proof."

5060-a. After "shall be" in the third line, insert "dust-ignition-proof and."

5060-b-2. After "shall be" in the first line, insert "dust-ignition-proof and."

5061-a-1. After "shall be" in the first line, insert "dust-ignition-proof and."

5061-b-1. After "shall be" in the first line, insert "dust-ignition-proof and."

5063-a. After "approved" in the fourth line, insert "as dust-ignition-proof."

5064-a-3. Before "enclosures" in the last line, insert "dust-ignitionproof."

INTERPRETATION NO. 432 (Effective June 8, 1956)

Section 5015; Seals Required in Raceways For Hangar Building Installations.

Statement: A hangar building consists of a hangar area and two adjoining areas cut off from the hangar area with eight-inch cement block walls. Fire doors cut off the openings between the hangar areas and the adjacent areas. Panelboards are installed in the adjacent areas more than 18 inches above the concrete floors. Runs of conduit go under a 10-inch concrete floor in the hangar area and connect panelboards in the adjacent areas. The adjacent areas are considered Class I. Division 2 areas for a distance of 18 inches above the floors. Two lengths of conduit are joined by threaded couplings made up tight within this 18-inch distance from the floor in one of the adjacent areas

Question No. 1—Under the conditions just given must seals, as covered in Section 5015, be used at each end of the conduit runs in the adjacent areas before they enter the panelboards?

Answer-Yes.

Question No. 2—If under the first condition seals are considered necessary, would they still be necessary if the conduit couplings that are now threaded and made up tight were welded?

Answer-Yes.

Question No. 3—Was it the intent of the Panel that seals, as described in Section 5015, be required in each conduit run where the conduit is encased in four inches of concrete in addition to being run under a one-foot thick concrete hangar floor?

Answer-Yes.

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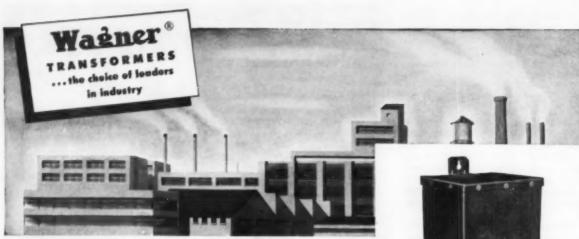
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For portable tools, machines or lighting systems, these compact, light-weight Wagner Dry-Type Transformers get the right voltage close to the load-give you a flexible, modern power system.

The 150° rise, totally-enclosed dry-type transformer is designed especially for use where ventilated transformers are impractical. Core and coil is protected from lint, moisture, dust and other contaminating materials by totally-enclosed sheet steel cases . . . and this kind of protection reduces maintenance to almost nothing. They can be installed outdoors, because their construction is completely weatherproof.

The 150° rise transformer is standard in ratings 3 through 10 kva and is also available through 50 kva. The 55° rise model is standard in 1, 11/2 and 2 kva and the 80° rise transformer is standard in ratings 15 through 100 kva.

Higher voltage single-phase transformers and three-phase transformers in ratings above 1121/2 kva are housed in ventilated enclosures formed of structural steel with removable panels. They are designed for floor or platform mounting and are suitable for indoor

Write today for Bulletin TU-57.



Single-phase Dry-Type Transformer. 150°C.



Single-phase Dry-Type Tranformer. 55°C.



Three-phase Dry-Type Transformer. 80°C.

Wagner Electric Corporation 6413 Plymouth Ave., St. Louis 14, Me., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS . TRANSFORMERS . INDUSTRIAL BRAKES . AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

## **Motor Shops**

#### **Progressive Office Methods Speed Servicing**

Close scheduling and frequent communication with working personnel in the field have made the Krug Electric Co., Inc., one of the largest motor service shops in New York City. The company now services over 25,000 motors, 96% of which are used in the printing industry, and guarantees ½-hour service on trouble calls to its customers—day or night.

To keep this number of motors running, Krug stocks 1000 spares in its shop and warehouse. New motors are bought and stocked as others become unserviceable; customers frequently get brand new motors as replacements.

Three 5-man crews are maintained in the field, each responsible for approximately one-third of the city. One man in each group is a foreman, who makes the assignments within the group. All men on the job are mechanics; none are helpers or apprentices. Each has his headquarters at one of the larger printing plants, where he is contacted by the group foreman. Each plant used as such a headquarters has enough motors in operation to keep the service man busy with rou-

tine maintenance between outside trouble calls.

At the motor shop, a modern service pegboard is maintained in the service superintendent's office which indicates the progress of each man along his service route, each man averaging about 25 routine calls per month. Daily reports made out by the repairman and signed by the customer are forwarded to the service superintendent, who transfers the data to the pegboard.

The board itself consists of a series of permanent metal pegs down the left-hand side attached to recessed elastic cord, each peg representing one service man. Nos. I to 25 across the top of the board represent each of the service calls the men are to make each month. The pegs are pulled out and stretched to the hole in the board representing the last completed stop by each man. Thus, the superintendent can tell at a glance at any particular time during the month whether any man is falling behind in his calls.

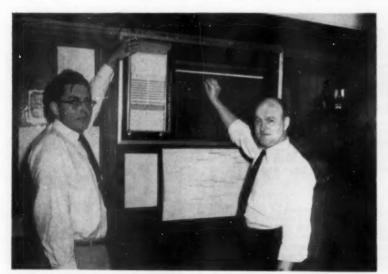
To the left of the board is a card file containing a card for each service route. This card lists in detail each of the calls to be made during the month.

To avoid the delay which usually occurs in handling trouble calls through the motor shop telephone switchboard, a special board fed by three trunk lines has been installed on the service superintendent's desk. This number is used by all customers: their calls are answered directly by the service superintendent, who can then place a call immediately to the appropriate field foreman. The superintendent logs in the time each trouble call comes in, the time the repairman is dispatched, his name, and the time the job is completed.

Two of the field crews have maintenance trucks; the third operates in downtown Manhattan, its territory comprising only a small area in the heart of the printing industry.

Depending upon the season, one, two or three men are on duty during the night to handle emergency calls, doing routine winding and repair in the shop between calls.

Effort has been made to keep shop repairmen acquainted with new equipment. Through an agree-



SERVICE PEGBOARD is used at Krug Electric Co., Inc., to maintain close watch on motor service calls. General Manager William J. Krug Jr. (left) holds cards containing detailed numbered lists of service calls for which each man is responsible. The pegboard at right, indicated by Stanley Hillman, service superintendent, contains a peg on an elastic cord for each service man which is moved progressively to the right on the pegboard as that man's calls are accomplished. Vacation schedule posted below board aids reassignments during summer period.



TELEPHONE SWITCHBOARD installed on service superintendent's desk enables him to maintain close contact with foremen, repairmen and customers without unnecessary delay through the main office switchboard. All trouble calls come in on this board.



#### Mr. Contractor:

#### Here's why Chromalox Electric Heat gets you a bigger share of home modernization money

#### NEW SALES APPEAL

More and more people are looking to electric heating than ever before. People like its cleanliness, its freedom from maintenance, the genuine comfort that only electric heating can provide. Each room has its own best temperature, without hot air blasts, with freedom of furniture arrangement. People find it ideally suited for the added-on room—installed at less cost than extending existing central systems.

#### NO CONSTRUCTION HEADACHES

With modern Chromalox built-in electric heating units installed in added-on rooms, finished attics, game rooms, closed-in porches or breeze ways, there is no need for expensive furnaces, flues, pipes, radiators or ducts. Installation is as simple as wiring lighting circuits. With proper insulation, the operating cost is surprisingly low. What's more, it means additional profits for you on the equipment and installation.

#### START LOOKING NOW!

Edwin L. Wiegand Company, world's largest manufacturer of electric heat for home and industry offers you a complete line of electric home heating equipment. Your Chromalox Distributor can help you with the ideas, applications and service that will put you in this new electrical market. See him today. Get the full story and ask to see the line-up of Chromalox packaged promotion material available for Electrical Contractors.

B-621

#### Edwin L. Wiegand Company

7637 Thomas Boulevard, Pittsburgh 8, Pa.



ment with the press manufacturers, when a new press is installed on a customer's premises one or more Krug men are on hand to observe its construction and learn its operation. This training is particularly important in the case of foreign printing equipment, more of which is being installed in this country today than ever before.

With more and more complex control being used, two of Krug's foremen were sent to Cleveland for schooling on electronic drives. When trouble develops on a press equipped with such a drive, an entire spare unit, kept in readiness at the shop, is installed to replace the defective equipment. The unit is then returned to service in its original application after being repaired in the shop.

#### Hydraulic Shear Speeds Coil Removal

In the shop of John McCarthy, Philadelphia, damaged coils are quickly stripped from slots of small motors through the use of a hydraulic cutter and tongs. The cutter, a P&R product, is foot-operated, leaving the operator's hands free to rotate an armature or otherwise position the motor being stripped. The shearing blade is motivated by a hydraulic plunger backed by 90 pounds of air pressure and, since the shearing head descends to the cutting table or returns to its raised, open position in accordance with application or



**FOOT PRESSURE** activates hydraulic plunger and shearing head with a 90-pound thrust, quickly severing end loops of damaged coils prior to their removal by tongs.

release of foot pressure, the resultant cutting action is quick and positive. Coils can therefore be severed on one side of the slots with minimum effort and can be drawn from the opposite side by tongs. The cutting unit is compact and neat, and it constitutes a useful time-and-effort saver in this active repair shop.

#### Motors Cleaned With Pulverized Corn Cobs

Pulverized corn cobs are being used to clean motors in the repair shop of the Industrial Electric Co., York, Pa., for it has been found that this method is both efficient and economical. Use of cob particles also reduces workers' skin irritations or eruptions, which are sometimes caused by other solvents.

Corn cobs are pulverized in a blasting machine, and cleaning is performed in a dusting booth equipped with a large suction fan. Shop policy also specifies that men use masks while cleaning, and experience has shown that motors can be cleaned in this manner faster, more economically and more efficiently.

Cob grits may be swept up. replaced in the storage tank and reused through an air hose many times over until such time as they are eventually pulverized to dust form and carried away by the suction of the exhaust fan.

When the cleaning booth is not in use, the operator closes the metal door, thereby preventing dust from drifting to other parts of the shop.



AIR NOZZLE and hose direct pulverized corn cobs against motor frame during cleaning process. Grits may be reused many times, until completely powdered and exhausted by means of the suction fan located above the cleaning table. Bi-parting metalclad doors prevent dust from drifting through shop when booth is inactive.

## Omark— HAMMER DRIVE

#### "NAILS" TO CONCRETE IN SECONDS WITH A HAMMER

No Drills • No Cartridges

Omark HAMMER DRIVE tools set fasteners in concrete or steel with 3 or 4 hammer blows. Drives headed or threaded hardened steel drivepins up to 4 inches long (over 30 types and sizes). No expensive drilling or fastening equipment needed . . . just a hammer. Not powder actuated . . . can be used anywhere.

Use it for hundreds of light fastening jobs: furring strips, cabinets, electrical conduit, window frames, shelving, tackless carpet strips, brackets, partitions, panel boards, ductwork and many others.

Ask your Omark dealer about HAMMER DRIVE tools, the inexpensive, speedy fastening method.





#### HOW TO USE Omark HAMMER DRIVE

- Select drivepin and insert into bottom of tool barrel.
- Insert correct driving ram into top of tool.
- Place tool on work surface and hit the ram 3 or 4 times with a hammer.

it's that simple! No complicated mechanism, no drilling, nothing extra to buy.

#### **Attractive Dealerships Open**

Write for Information

You Always Get a Snug, Sure Fastening With Omark Ballistic Pointed Drivepins



Ordinary drivepins have straight shank, round point. Cause hole enlargement and fastening has less holding power. Pin is hard to drive and tends to buckle.



Omark pins have ballistic taper. Prevents hale enlargement. Gives snug, high-pullout fastening. Easy to drive, doesn't buckle. Better fastenings result.

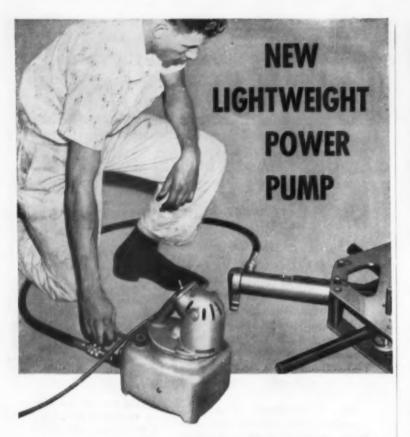
The Only Complete Line of Drivepins

Headed, 1/4"-20, 10-24 and 8-32 threaded pins from 1/4" to 3" long (4" on request).

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## of your hydraulic pipe benders and hydraulic rams of all types

Put this powerful, portable power pump to work on your hydraulic tools and see how much easier and faster your jobs go.

This new, lightweight Greenlee 798-CO pump can be used not only on Greenlee hydraulic pipe benders and pushers, but on hydraulic rams of all descriptions.

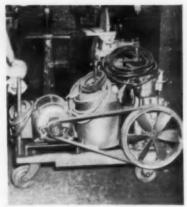
Weighing only 50 pounds . . . some 40 pounds less than previous types . . . this new Greenlee power pump with aluminum alloy motor closure and pump housing is easily carried from job to job.

Other advanced features include quick approach, adjustable-pressure valves, and a powerful ½-hp universal motor that operates on 110 a-c or 115 d-c current. Thus, this pump may be used in any plant or on any job without questioning the type of current available.

Get the complete story today, write for details on the new Greenler 798-CO portable power pump that saves work, speeds jobs, and brings extra profit to your operation.



GREENLEE TOOL CO., 1749 COLUMBIA AVE., ROCKFORD, ILL., U.S.A.



**COMPRESSOR** can be freely moved around the shop from job to job, thereby eliminating the necessity of carrying work to one fixed location, as was the case before this caster-mounted angle-iron dolly was fabricated in the Industrial Electric shop.

#### Compressor Mounted On Mobile Dolly

A special caster-mounted rack, constructed to hold all equipment related to an air compressor, has been fabricated in the motor repair shop of the Industrial Electric Co., York, Pa. This makes it possible to shift the compressor to various job sites, rather than having to move the various jobs to a fixed compressor location, as was the case formerly.

As indicated by the accompanying picture, the rack consists of a 2-by-4-ft welded channel iron frame onto which the air compressor, drive motor, tank, hose and extension cords have been placed. Two swiveling wheels are mounted on one end of the rack, while two stationary wheels support the other end.

Manual movement is facilitated by the inclusion of a pipe-formed handle which is welded at one end of the compressor.

Another useful item in this shop is the sanding disc noticed in the right background. Equipped with a suction hose and intake hood which is located immediately beneath the bedplate of the sander, the air is kept free from any dust created during a sanding routine. As noticed also, the bedplate is slotted to permit the use of various guiding or width-determining devices, and the bedplate is also pivoted to permit its adjustment at any desired angle up to 45 degrees. Such features add to the accuracy of the work performed, permit ready sanding of angular-faced stock, and result in safer operation.



## ALL-WAYS BEST! Curtis 4060 series luminaires

BEST ILLUMINATION—low-brightness of the Forty-Sixty blends with the illuminated ceiling, producing high levels of quality illumination.

BEST DOLLAR-VALUE-you may pay a little more, but you'll never get more, and there's 116 different luminaires to choose from.

BEST QUALITY MATERIALS—highest purity aluminum or heavy gauge steel for maximum uniformity and durability.

BEST SKILLED CRAFTSMENSHIP-built to closest tolerances for rugged, neat construction and greatest customer satisfaction.

BEST GUARANTEED FINISHES—Alzak aluminum or baked white Fluracite enamel on steel—both are fully guaranteed under standard service conditions and proper use.

**BEST TO INSTALL**—the continuously grooved Forty-Sixty Series wire channel makes hanger placement flexible to job conditions when patented Curtis "Tong" hangers are used.

**BEST PROFITS**—because Curtis Forty-Sixty Series luminaires give your customers the best dollar-value, quality materials, skilled craftsmenship, and guaranteed finishes, you get satisfied customers and more repeat business, plus easiest on-the-job installation with minimum service costs. So buy the only complete, all-purpose line of luminaires that's always best, get Curtis Forty-Sixty Series luminaires.

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## "We Hooked it Up and Walked Away"

In the electrical signaling and communication industry this expression, coming from an electrical contractor, is the highest recommendation he can give of a manufacturer's equipment. It means "Well done! Your system installed easily and worked properly the first time. No rejects... no grounds or shorts... no trouble shooting, with all that means in running up the cost of a job. It worked like a charm!"

We're accustomed to hearing this expression quite frequently at Auth. Our equipment has always been designed to make installation easy. We give the contractor what he needs . . . wiring diagrams, equipment draw-

ings, installation and operating instructions. All material is thoroughly tested before shipment.



We... at Auth... do this not only because it comes naturally. We do it because every time a contractor says to us "We hooked it up and walked away," we know that he'll be coming back to us on the next job. That's good will.

Manufacturers of

ELECTRICAL SIGNALING,
TIME AND COMMUNICATION
BYSTEMS FOR HOSPITALS,
SCHOOLS, HOUSING,
INDUSTRY AND SHIPS

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# In The News

## IES Gold Medalist Is Dr. Grampton

The 1956 Gold Medal of the Illuminating Engineering Society, highest award of the Society, has been awarded to Dr. George S. Crampton, Philadelphia ophthalmologist, teacher, inventor of many optical devices, and owner of the Lenox Instrument Company Philadelphia. The award will be presented to Dr. Crampton on September 18th at the Convocation session of the 50th Anniversary National Technical Conference of IES in Boston. Robert F. Hartenstein. president of the Society, who announced the decision of the IES Medal Award Committee recently, will make the presentation.

The IES Gold Medal is given annually to individuals who, "by distinguished contributions, have conspicuously furthered the art, knowledge and profession of illuminating engineering". Dr. Crampton is the eleventh individual to be so

honored.

Dr. Crampton, who is 82, has throughout his long career been closely allied with lighting and its aims and objectives in improving sight and vision. He has been a leader in his own profession of ophthalmology in coordinating the work of the oculist and the illuminating engineer. He joined the Illuminating Engineering Society in



DR. GEORGE S. CRAMPTON



OUTSTANDING PERFORMANCE in numbers of Certified A. W. homes wired won recognition for these Cleveland contractors. John U. Walker, president of Midland Electric Co. and of the Electric League of Cleveland, congratulates Sanford Kahn, Kahn Electric Co., E. P. Burroughs, Burroughs Electric Co. and H. C. Morlock, Reliable Electric Co.

1914, and in those early years of the Society presented many papers before their meetings, stimulating an interest in the mutual goals of the oculist and the lighting engineer. He has served on many IES committees and held numerous elective offices, local and national. He was President of the Society in 1921-1922, and is still active.

Dr. Crampton has been a surgeon at Wills Eye and Pennsylvania hospitals, Philadelphia. He has lectured on refraction, a field in which he has invented many unique instruments, and was Professor of Ophthalmology at the Graduate School of Medicine of the University of Pennsylvania where in 1939 he was named Professor Emeritus.

Although Dr. Crampton is a physician, his optical work frequently required that he design special lighting equipment for his novel instruments. He was the designer of the first ophthalmoscope using a tungsten filament lamp. In recent years he has invented many optical instruments of the borescope type in which lens systems and lighting systems are combined to make possible the inspection of the interior of long tubes, such as gun bores. One version of this instrument is equipped with an automatically rotating camera lens which makes a photograph of the entire inside surface of a gun barrel, inch by inch on a film strip. Some of his specially designed and custom built boroscope systems have been used for six of the Atomic Energy Commission installations.

One of Dr. Crampton's earliest activities in optical illumination was a 1909 improvement on an ophthalmoscope — an instrument used to examine the interior of the eye.

Dr. Crampton is an Emeritus member of the American Ophthal-mological Society, a member of the Optical Society of America, a Fellow of the College of Physicians of Philadelphia and a member of the Philadelphia County Medical Society, the Pennsylvania State Society, and the American Medical Association.

## Cold Cathode Industry Organizes

The cold cathode lighting industry, comprising those manufacturers engaged in the production and sale of cold cathode type fluorescent lamps and tubes used for light sources and lighting purposes, has formed a new trade association, the Cold Cathode Association, Inc. (CCA). This new organization has been formed "to promote tech-

## What's a square foot worth to you?



can increase its productive value!

API's local inventory and service facilities can help you increase square foot floor space value for productive uses by eliminating heavy warehousing requirements.

At any of API's local inventory and service centers, you will find a wide variety of A-MP® Terminals, Connectors and Tools to meet all your service requirements. Order only the amount to satisfy your service needs. Call API's nearest branch office for inventory, service and technical assistance!

In addition to branch offices, API maintains a group of local telephone information centers for your convenience.



### dependability 2 ways

The product and the product knowledge of the API man who serves you.

#### AMERICAN PAMCOR, INC.

Subaidiary of Aircraft-Marine Products, Inc. 181 Hillcrest Ave., Havertown, Pa.

\*Consult the yellow pages of your local telephone directory under AMERICAN PAMCOR, INC., for local telephone center number.



20 hours in time \$64 in materials

AVED ON ONE JOB WITH A TAL PORTABLE BENDER

> by the Chicago

П

By making 12 90° bends in 6 3" conduit with a TAL ONE-SHOT BENDER instead of using elbows and couplings, time was cut from 59 to 39 hours . . . \$134 was saved on labor and material on installation of a 250 hp, 220 volt, 3-phase air compressor in the shop of the Diamond T Motor Car Co., Chicago. This was possible only because a TAL ONE-SHOT completes bends in one setting-no shifting of pipe is necessary!



EXTRA STUB HOLE

SIX WAY HON-SLIP SHORT BEND. ING JAWS for close quarters or open slab work. Non-Slip, Accurate, Rapid and Easy Bending.

SAFETY NECK for SURE GRIP.



- · For pipe up to 8
- For copper and thinwall
- 6-Way Hickeys do what others can't d



of Ten Each \$3.10 ... \$3.70 4.65 3.90 ea. 7.95 6.65 ea



A. LINCOLN BUSH, president, Belmont Electric Co., and Harold A. Olson, commercial vice president, General Electric Co., were chairmen of sessions at the recent convention of the New York State Association of Electrical Contractors and Dealers, held at Saranac Inn, N. Y.

nological advances of cold cathode lighting", according to Bert C. Pretzer, president of Illuminating Engineering Co. of Detroit, who was elected president of the newly

organized association.

The new group plans to issue its own label for certification. It is their aim, according to Mr. Pretzer, to establish the best certification possible for cold cathode lighting, and to see to it that qualifying standards are not violated. Certification will be open to any individual or company meeting its requirements and specifications. CCA By-Laws stipulate, however, that it will not indulge in sales promotion for its membership. The association will further disseminate educational material regarding proper cold cathode specifying procedures, applications, and technical data.

Other officers elected were: Vice President-Thomas Cortese, president of Colorescent Lighting, Inc., Elizabeth, N. J.; Secretary—Rudolph C. Hultgren, president of CELine, Inc., Batavia, Ill.; Treasurer-Victor H. Todd, president of Swedish Iron and Steel Corp.,

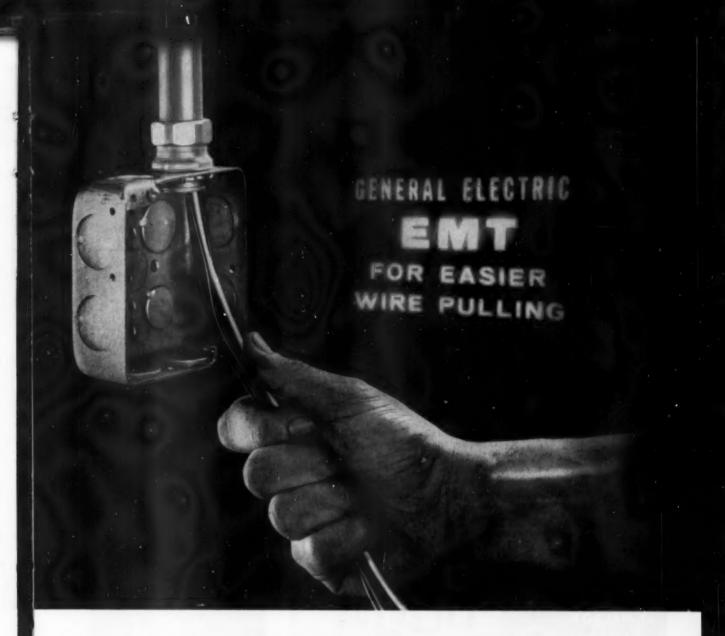
Westfield, N. J.

### **NISA News**

NISA's latest list of new members includes two from Mexico, bringing the total membership in the country to three shops. The new members are Electrica Industrial in Monterrey and Taller Electrico in Maldonado.

. . . . G. E. Jones Electric Co. of Ama-

DEPT. 27 . MILWAUKEE 2, WISCONSIN



## No snagging...and it's so easy to pull through!

For greater speed in your wiring jobs get the advantage of easier wire pulling with General Electric EMT. It has a low-friction interior surface produced by a special baked-on Glyptal\* coating. And the exclusive continuous induction weld means no splits—and no burrs to snag and tear insulation.

In addition, General Electric EMT is easier to bend because of its uniform cross-section—it does not tend to kink or flatten. Another convenience is the color-coded binding tape used to bundle EMT. You can identify the size instantly—at a glance. General Electric EMT is available throughout the country from G-E Construction Materials distributors. For more information see your distributor or write Section C69-918, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

\*Registered Trade-mark General Electric Company

Progress Is Our Most Important Product





\*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



### **BUFFALO FORGE COMPANY**

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

INDUSTRIAL EXHAUSTERS

BELTED VENT SETS

PROPELLER FANS

"E" BLOWERS-EXHAUSTERS



rillo and Borger, Texas, has opened a branch shop in Plainview, Texas.

A NISA Associate member, Electric Service Manufacturing Co., Philadelphia, has affiliated with the Delta Star Division of the H. K. Porter Co.'s "family of industries" of the same city. Personnel and location remain unchanged, a company announcement stated.

New Orleans Chapter met Aug. 28 at Irwin's Restaurant to see a color slide film presentation of Brook Motor Corp.

A joint meeting of NISA's Los Angeles and San Diego Chapters was held Aug. 11 in the latter city at Hotel Lafayette. The day-long meeting included shop visits, forums and—for wives—a sight-seeing tour and lunch. The entire group had dinner in the evening, then attended a performance of "Hit the Deck" at the city's open air theater.

In Oakland, Calif., the Northern California Chapter held its summer meeting June 11 at Steeplechase Inn.

. . . .

Following a custom of many



RESIDENTIAL LIGHTING profits have decreased year after year as dollar volume per home has dropped, and selling costs have increased, according to Victor C. Perero, who owns and operates El Cerrito Electric, Inc., El Cerrito, Calif. He still maintains a "fixture" showroom, but devotes most of his efforts to residential and commercial wiring and contracting, and to the sale of household appliances which are displayed in a large adjoining solesroom.



Quick, low-cost installation is promoted by Transite Ducts. The light, 10-foot lengths are easily handled . . . and readily joined with either Transite Couplings or J-M Plastic Couplings. Many fittings are available to simplify even the most complicated installation. The permanently smooth interior surface of these asbestos-cement ducts prevents cable injury, makes long pulls possible and simplifies cable replacement.

Incombustible Transite Ducts confine arc damage, protecting adjacent cables from heat and flame. Inorganic, nonmetallic, Transite Ducts are corrosion-resistant, immune to rust and rot and unaffected by electrolysis. These ducts dissipate heat faster, reducing 1<sup>2</sup>R losses, enable cables to carry heavier loads and prolong insulation life.

Available in 2 types: Transite Conduit for exposed work and installation underground without concrete encasement; and Transite Korduct for installation in concrete.

Let us send you more information about Transite Ducts.

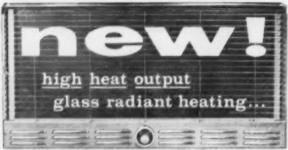
Just write to Johns-Manville, Box 14, New York 16, N. Y.



## Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT®—for Installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



# competes with <u>any</u> low cost heating!

New Berko units bring huge expansion in market for supplementary heating ... makes whole house heating economical ... profitable!

For the first time, the finest quality glass electric radiant heating can compete in cost with all other heating systems! Only Berko has developed the new units that make this possible. Because these new units have much higher heat output, fewer units are required As a result, the cost and time of installation is cut to a bare minimum. The Berko High Heat Output Series features units in wattages of 750, 1250, 2000 and 3000 watts! Available with built in thermostat.

Write, wire or phone your electrical distributor for further details or write;



**BERKO** 

ELECTRIC MANUFACTURING CORP. 212-40 Jamaica Ave., Queens Village 28, N. Y. HOIlis 5-1047





Write for Bulletin 48-3
Engineering
Representatives
in Principal Cities

who normally cannot be reached di-

rectly by telephone. The busy switch-



other signalling devices.

bination of chimes, bells, horns and



ROBERT B. BERGER, president of B. B. Electrical Contractors Inc., Paterson, N. J., combines sound business acumen with his thorough technical background in directing the fortunes of his large electrical contracting firm which specializes in pole line construction.

years' standing, Louisville Chapter held its summer picnic at Blackiston's Mill in southern Indiana Aug. 2.

Members of the women's committee for the 1957 NISA Convention, to be held in Buffalo May 12-15, have been named by Mrs. Glenn T. Wardell, woman's program chairman. Members are: Mrs. Henry Z. Lang Sr., fashion show; Mrs. Glen A. Frosdick, tour; Mrs. Al Volland, lunch; Mrs. Chester Tanner, baby sitters; Mrs. Harry Edwards, favors; Mrs. James Robertson, prizes; Mrs. Clifford Nelson and Mrs. John Schlehr, bus hostesses and reception: Richard Keenan and Mrs. S. Karaskiewicz, information booth; Mrs. Frank Egloff and Mrs. Cort Worth, promotion.

Committeemen for the Ontario Chapter for the coming year include Ted Waffle, membership; A. C. Jenkins, publicity; G. H. Bedford, apprenticeship; E. L. Dodington, costs; N. W. Finnie, technical and methods; W. F. Toll, program; H. C. Blenkhorn, by-laws.

A representative of Baldor Electric Co. spoke to Greater Cleveland Chapter July 16, discussing motor distribution problems. A member of the sales staff of Ohio Carbon

full voltage . . . non-relay

# Rodale Touchette

single button convenience at the merest touch



EASY TO OPERATE—no toggle to flip...no knob to turn. Just a touch and it's lit... quietly! Another touch... Touchette is off... without the loud click of the standard toggle switch.

VERSATILE ... FITS STANDARD PLATES—no need to replace favorite wall plates. Touchette dimensions conform to the opening of standard toggle wall plates . . . permit an economical change over.

OPERATES ON FULL LINE VOLTAGE-needs no special wiring, relays or transformers.

RATING-15A-120-277V. AC ONLY-for incandescent or fluorescent lighting systems. Can be used in new 277/480V systems. Single pole, double pole, three-way and four-way models . . . brown or ivory button.

UNDERWRITERS' LABORATORIES APPROVED.

Complete information and prices. Write: Rodale Manufacturing Company, Inc., Dept. M-9 Emmaus, Pennsylvania.



touch ... it's lit

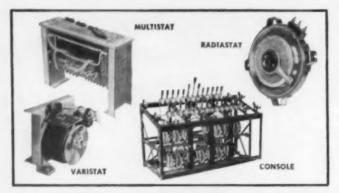


touch...It's off

PATENT APPLIED FOR

RODALE MANUFACTURING COMPANY, INC.

EMMAUS, PENNSYLVANIA



## Lighting dimmers for FREE-STANDING BOARDS . CONSOLES WALL MOUNTING PANELS

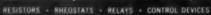
You'll find a dimmer for every application in Ward Leonard's adjustable autotransformer line.

For example, there's the 2.5 kw VARISTAT, the 6.6 and 8 KW RADIA-STATS, and the 6 and 12 kw MUL-TISTATS for interlocking or noninterlocking control. Manual or remote-control motor operated.

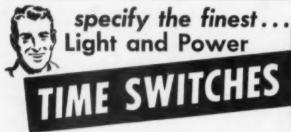
Learn more about autotrans-former dimmers for compact fullrange, flickerless and efficient lighting control of incandescent and fluorescent lighting. Write for Bulletin 76. Ward Leonard Electric Co., 33 South Street, Mount Vernon, N. Y. (In Canada: Ward Leonard of Canada Ltd., Toronto).

#### WARD LEONARD ELECTRIC CO.

Result- Engineered Controls Since 1892







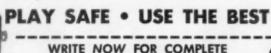


## Before you specify any Time Switch check these TORK plus-value features!

- √ Skip-A-Day, Seven Day and Astronomic Timing

- ✓ High Quality all-brass plates and gears
- √ Ratchet type dial for positive check of switching

TORK'S practical "Complete Line" provides the widest variety of timing dials, rugged switches, and all-purpose enclosures to meet any automatic ON-OFF application. TORK has been an exclusive manufacturer of high quality Time Switches for over 33 years.



**DETAILS and SPECIFICATIONS** 

Low Cost TORKMASTER #948 TORK CLOCK Co., Inc.

MOUNT VERNON, NEW YORK



Co. was also on hand to answer questions on types and applications of carbon brushes.

Ontario Chapter held a meeting June 2 at Seven Dwarf's Inn in London. Cliff Foster of Minnesota Mining & Manufacturing Co., Ltd., discussed his firm's various products that have electrical application and exhibited two motion

The Florida Section of Southeastern Chapter held its semiannual meeting in Tampa Aug. 24. A cocktail party was given by Tampa Armature Works whose president, J. Arthur Turner was arrangements chairman.

Chairman for NISA's national committees are: Publication and Publicity, John W. Overton of Electric Motor & Repair Co., Richmond, Va.; Chapter Affairs, Joseph H. Previty, Penn Electric Motor Co., Philadelphia; Marketing, John M. Young, Anderson Young Co., Lubbock, Texas; Audit, Joseph H. Previty; Award Contest, Alex A. Shovan, Industrial Electric Service Co., Hawthorne, N. J.: Budget, Frank W. Ross, Ross Electric Motor Shop, Fairmont, Minn.; By-Laws and Resolutions, John M. Young; Canadian Affairs, H. C. Blenkhorn, Blenkhorn & Sawle, Ltd., St. Cath-



CHECKING DETAILS of some of the extensive signal wiring in construction of the River Edge Elementary School, River Edge, N. J., are Bill Engelbrecht, right, foreman for Walter J. Coleman & Co., electrical contractors of Jersey City, N. J., and Larry Monchek, electrician.

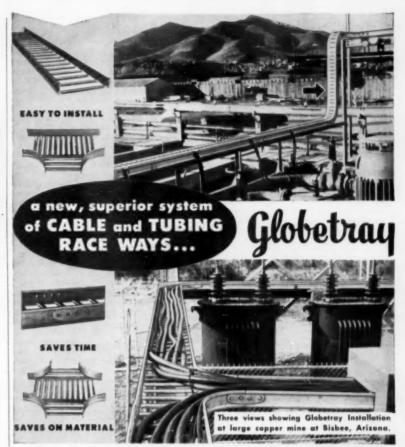


RAY BLEAKLEY is a top-flight sales engineer and detail man on all operations at B. B. Electrical Contractors, Inc., Paterson, N. J., where he handles estimating details and keeps a smooth flow of routine and special materials needs on all jobs.

arines, Ontario.

Other committee chairmen include: Territories and Boundaries, T. M. Paul of Paul Electric Co., Sioux City, Iowa; Employee Training, Paul M. Sievert of Sievert Electric Co., Chicago; Group Insurance, Joseph F. Dudley of Dud-ley Electric, Flint, Michigan; Industrial Relations, Frank W. Sloan, San Diego; Membership, Murphy G. Miller Sr., Tennessee Electric Motor Service, Knoxville, Tenn.; Public Affairs, William J. Wheeler, The Maintenance Co., New York; Rebuilding Standards (Motor), H. C. Blenkhorn; Rebuilding Standards (Transformers), Ben J. Horton, The Atkinson Armature Works, Pittsburg, Kansas; Sales Survey, Selden F. High, The Sullivan Electric Co., Cincinnati; Trade Relations, Alfred Elson Jr., New England Machine & Electric Co., Pawtucket, Rhode Island; Used Equipment, Carl Lundberg, Cascade Machinery Co., Seattle, Washington; Engineer's Advisory, J. A. Turner Jr., Tampa (Florida) Armature Works.

NISA's new annual directory, the "Yearbook," is off the press. A geographical listing of all members, the Yearbook also includes names of officers, directors and chapter officers. Copies are available from NISA National Headquarters, 818 Olive St., St. Louis 1, Mo., for \$2.00 each.



A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side chamnels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point — insides and bottom always smooth — all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.



# PARE FORECAST:

## BIGGER Air-Conditioning LOADS in 1957!

ECONOMIZE! Why purchase oversize standard rating transformers to accommodate your Air-Conditioning load?

## PRECISION

will match your load with the right size transformer for every popular size of Air Conditioning unit!

AIR	CONDITION	NG LOAD CH	ART
	Normal KVA Full Load		
	WINDO	W UNITS	
1/2-H.P.	1.0	1.5	TD1-A01
3/4-H.P.	1.5	2.0	TOI-AZ
1-H.P.	3.0	3.0	TDT-A3
11/2-H.P.	2.4	3.0	TD1-A3
	COMMERC	IAL UNITS	
2-Ton	3.5	8 '	TD3-A5
3-Ten	4.5	6	TD3-A6
5-Yen	8.8	10	TD3-A10
71/2-Yen	12.0	15	TD3-A15
10-Yen	14.0	26	TD3-A20
15-Ton	22.0	25	TD3-A25
20-Yen	26.6	30	TD3-A30

(Above are average values using highest average ambients in U. S. as compiled from data supplied by a leading Air Conditioner manufacturer.)

### MODERNIZE with PRECISION

Most Complete Line of DRY-TYPE TRANSFORMERS

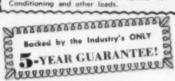


Single-Phase 2500 KVA

Three-Phase: 3 KVA to 3000 KVA

up to 15,800 velts!

Special Transformers, Saturable Reactor and Core and Coil units for special A Conditioning and other loads.



- Extre-Rugged Construction!
   Easy Installation!
   Extremely Quiet Operation!
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   Operating Economy!

JOBBER STOCKS in all principal cities-contact your jobber, PTC representative or PTC plant today.

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### DATES AHEAD

International Association of Electrical Inspectors - Section meetings Hotel, Salt Lake City, Utah, Sept. 10-12; Southwestern Section-Claremont Hotel, Berkley, Calif., Sept. Northwestern Section — Newhouse 17-19; Western Section—Statler Honadian Section—Park Plaza Hotel, tel, St. Louis, Mo., Sept. 24-26; Ca-Toronto, Ontario, Canada, Nov. 2-3; Eastern Section—Wentworth-by-the-Sea, Portsmouth, N. H., Oct. 15-17; Southern Section - Statler - Hilton Hotel, Dallas, Texas, Oct. 22-24.

Florida Association of Electrical Contractors-Fourth Annual Convention and Electrical Show, Balmoral Hotel, Miami Beach, Fla., Oct. 24-27.

Illuminating Engineering Society-National Technical Conference, Hotel Statler, Boston, Mass., Sept. 17-21.

Instrument Society of America-Eleventh Annual Instrument Automation Conference and Exhibit, Coliseum, New York City, September 17-21.

National Industrial Service Association —Southwestern Chapter, Biltmore Hotel, Oklahoma City, Okla., Sep-tember 20-22; Central District Chap-ter, Chicago, Ill., September 11.

National Electrical Contractors Assn. 55th Anniversary convention and Second National Electrical Exposition, Civic Auditorium, San Francisco, Calif., September 23-29.

National Electronics Conference-Hotel Sherman, Chicago, Ill., Oct. 1-3.

International Association of Electrical Leagues — 21st annual conference, Sheraton - Cadillac Hotel, Detroit, Mich., October 3-6.

Canadian Electrical Manufacturers Assn.—12th annual meeting Shera-ton Brock Hotel, Niagara Falls, Ont., Canada, October 3-5.

National Safety Council—44th Safety Congress and Exposition, Conrad Hilton Hotel, Chicago, Ill., October 22-26.

National Electrical Manufacturers Association — Annual meeting, Tray-more Hotel, Atlantic City, N. J., November 12-16.

American Institute of Electrical Engincers-Winter general meeting, Hotel Statler, New York, N. J., January 21-25, 1957.

National Electrical Week-An all-industry event, February 10-16.

National Electric Sign Assn.-Annual convention and exhibit, Sheraton Park Hotel, Washington, D. C., February 24-28.

American Society of Heating and Air Conditioning Engineers — Annual meeting, Chicago, Ill., February Annual 25-28.

13th International Heating and Air Conditioning Exposition — Chicago, Ill., February 25-March 1.

National Electrical Manufacturers Assn.-Edgewater Beach Hotel, Chicago, Ill., March 11-14.

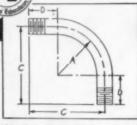
Fourth National Electrical Industries Show--Sponsored by Eastern Electrical Wholesalers Assn., 71st Regiment Armory, New York City, April

National Association of Lighting Maintenance Contractors-Fourth Annual Meeting, Hotel Muelebach, Kansas City, Mo., April 29-May 1.

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SIZES OF SPECIAL

# LARGE RADIUS 90° ELBOW



radius "A" in inches	offset "C"	straight end "D"	length unbent	pipe sizei
12"	1'9"	9"	3'0"	1"-21/2" inc.
15"	2'0"	9"	3'6"	1"-3" inc.
18"	2'4"	10"	4'0"	1"-31/2" inc.
24"	2'11"	11"	4'11"	1"-4" inc.
30"	3'5"	11"	5'9"	1"-5" inc.
36"	3'11"	11"	6'6"	1"-6" inc.
42"	4'6"	12"	7'6"	1"-6" inc.
48"	6'0"	12"	8'4"	1"-6" inc.
A		ilable 45 are U.L.		

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ves the Need of a STURDY - STRONG STAPLE Drives Straight — Will not Bend under any Mard Hitting Punishment. All Cable Jobs MUST have the Sturdiest of Staples. THIEL has the Newest Improvement in these products — THEL "Easy-Drive" — "Naül-tr" — "Easy On" Straps. Sold by reputable Electrical Wholesate Dealers. Send for free samples.

1100 Small (2) Wire Thirt Staples in for M.M.C. 212-14 1125 Large (3) Wire Thirt Staples in for N.M.C. 214-12-10

THIEL TOOL & ENGINEERING CO., INC. ST. LOUIS 6, MO.

#### WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: Must an electrical contractor provide a safe place to work for an employee of another sub-contractor?

A large apartment house development was being erected and Jones was a prime contractor for the installation of electrical work and energizing the lines. Under his contract, he was also made responsible for providing lighting throughout the construction during working hours.

One day, Mr. Batt, an employee of the plastering sub-contractor, entered one of the buildings to do some work. On one of the upper floors, he allegedly was confronted by a complete blackout. There were no lights burning.

The result? In the darkness, Mr. Batt started down a flight of stairs that had not as yet been installed. Badly hurt in the fall, he sued Jones for his injuries.

"Jones was supposed to keep the building properly lighted so other workers on the job would have a safe place to work," the plasterer pointed out in court. "Since he failed to do it, he should be held responsible for my injuries."

THIS WAS THE DECISION: The court ruled against the plasterer. It said a prime electrical contractor owes no duty either at common law, under labor law or other statutory law to supply the employee of a sub-contractor of the prime construction contractor with a safe place to work. Nor does any statute impose a duty on one sub-contractor to furnish a safe place to work to the employee of another sub-contractor.

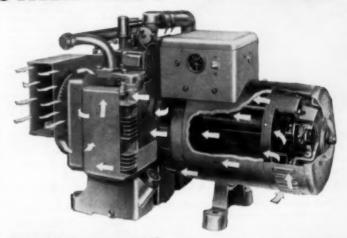
If Jones breached his contract, concluded the court, he did so with the owner of the property and not with the plasterer with whom he had no contractual relationship or obligation. Therefore, the plasterer could not collect from Jones for his injuries.

(Based upon a 1955 New York Decision. State laws vary. For personal guidance, see your local attorney.)





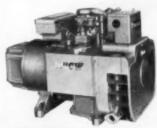
# SIMPLIFIES INSTALLATIONS OF ONAN ELECTRIC PLANTS





#### VENTILATES INSTALLATION AREA

Vacu-flo cooling takes air from the room, through the electric plant, and expels it autside through a single duct. Eliminates fumes; keeps room filled with fresh air.



#### DUCT CARRIES EXHAUST LINE

On the Onan CW series of electric plants  $(7\frac{1}{2})$  and 10KW, the exhaust pipe is carried through vent duct to the outside making only a single opening necessary.

## Heated air expelled outside through single vent. Units can be enclosed or "buried"

Air-cooled Onan Electric Plants can now be installed in small, enclosed compartments; in isolated or underground rooms; or "buried" within a vehicle, far from the outside air. Previously impossible or difficult installations are now easy and practical with Onan Vacu-Flo cooling.

This exclusive system is a factoryequipped item, optional on any Onan air-cooled electric plant. A quiet-running, centrifugal blower in a specially-designed housing PULLS cooling air through the generator and over the engine . . . then EXPELS heated air through a duct to the outside.

The space required in a "buried" installation need be only a little larger than what the unit itself requires. Airintake and vent openings plus an exhaust line are all that are necessary.

On vehicles such as trailers, display vans, fire and rescue trucks, and concession wagons, Vacu-Flo cooling makes it possible to mount the Onan plant anywhere in the body where space is available. On pleasure and work boats, Vacu-Flo cooling makes below-deck installations of air-cooled electric plants practical . . cooling efficiently and quickly eliminating fumes from the area. Onan Electric Plants with Vacu-Flo

Onan Electric Plants with vacuum ocooling operate more quietly than blower-cooled models . . . an important added advantage in many installations.

Write for Special Vacu-Flo folder.



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Because it is no ordinary motor—the stator, rotor, windings, electrical varnish used and the bearings are designed and selected to give long, trouble-free service under the toughest conditions. Yet, BROOK MOTORS cost no more than ordinary motors—usually they cost less. No wonder so many mills, gins, quarries, factories, petroleum producers and others using BROOK MOTORS praise them so highly. Send for construction feature Bullotin 827.

Open Drip Proof (shown), Totally Enclosed Fen Cooled, Totally Enclosed Non-Ventilated, NEMA Special Motors, Squircel Care

"C" and "D" Flange, Extended Shaft Pump Motors, Special Motors, Squirrel Cage or Slip Ring, stocked in a wide range of sizes.

#### FAST DELIVERY OF ALL POPULAR MODELS:

Brook Motors are available from warehouse at Chicago, Dallas, Jersey City, Los Angeles, Memphis, St. Paul, Salt Lake City, San Francisco, Savannah, Seattle, Tampa, and other major distributing points.



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BOUND COPY of the "Story of Lighting in the White House" was recently presented to Homer H. Gruenther (center), a member of President Eisenhower's staff of executive assistants by Robert F. Hartenstein (left), president of the Illuminating Engineering Society. The illustrated booklet was prepared by Dr. Samuel G. Hibben (right), IES past president and chairman of the Society's Historical Committee, shown here explaining to Mr. Gruenther that the booklet contains the nation's first planned lighting specification, prepared for President James K. Polk and his official family. Based on correspondence and other data long forgotten in the Library of Congress, the booklet has been passed on to Mrs. Eisenhower for the White House archives, Presentation was made in the rose garden of the White House during the IES East Central Regional Conference in Washing-

# **Book Reviews**

## New Office Lighting Guide

The Illuminating Engineering Society has announced publication and availability of its new "Recommended Practice for Office Lighting". This is the first revision of this important lighting guide since 1947, and was prepared by the Society's Committee on Office Lighting. It includes results of consultations over the past six years with representatives of the IES Committee on School Lighting, the American Institute of Architects, and the National Council for Schoolhouse Construction. It is 32 pages in length, completely illustrated, and has much of its valuable information arranged in tabular form for easy reference, making it an excellent manual for anyone concerned with the problem of office lighting.

The revised edition "Recom-



E. G. MAY, chairman of the Board and William L. Drexler, president of the New York State Association of Electrical Contractors and Dealers, were kept busy at the recent convention held at Saranac Inn, N. Y.

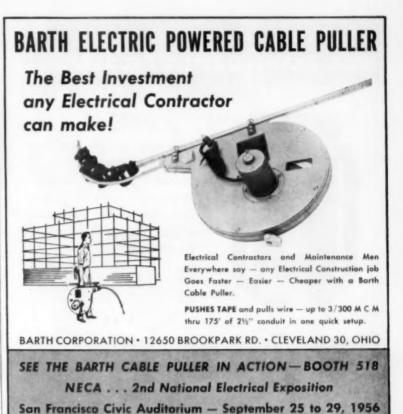
mended Practice" is based on the concept of lighting for specific tasks. It introduces the subject with a general description of office lighting operations, in which the eyes are used at close range for severe visual tasks. These include reading duplicated material, handwriting, pencilled stenographic notes, typing and fine print. "The visibility of such work is often poor and more attention should be devoted to its improvement" the Committee states, and recommends specific preferred type sizes, paper finishes, ink, etc.

Other subjects covered include the influence of lighting on seeing, and the influence of environmental factors. These are subdivided into such headings as: Quantity and Quality of Illumination; Recommended Illumination Levels (for seeing tasks in 18 typical office departments); Glare (with table of acceptable brightness limitations); and a detailed discussion of reflectances as to finish and color of ceilings, walls, furniture, office machines and equipment, and floors. Of particular importance and value are the final sections which deal with lighting systems and specific

The "IES Recommended Practice for Office Lighting" is 84 in. by 114 in. in size. It is published by and is available from the Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y. Price of single copies is 50 cents.

## **Factory Electrification**

A compact, but comprehensive exposition of the full range of systems and equipment employed in modern industrial electrical net-





# LET OUR ENGINEERS SOLVE YOUR TRANSFORMER PROBLEMS



Standard Transformer engineers work with your engineers to solve transformer problems at no cost to you. Send us your plans and let us work out a practical, efficient, and economical solution. Write Standard today. There's no obligation.

Type "A" Distribution Transformer, 75 KVA, 2400/4160Y to 120/240 volts, single-phase, 60-cycle. One of a complete line of Standard Transformers developed for every class of service.



Carry WATER, GAS AIR LINES, CABLE at any angle to beams

"EFFICIENCY"

CONDUIT
HANGER

"TYPE F"

On open steel construction. Efficiency "Type F" conduit Hangers are your best choice for carrying ½" to 2½" pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cables suspended dead center, permitting it to be carried securely at any angle to the beam.

Write today for Catalog 38-A.









"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION



works from the service to the rotating devices. Although the book uses some British terminology and standards, it will prove a valuable information source to the engineering executive. By F. T. Bartho & C. H. Pike. Philosophical Library, Inc., 15 E. 40th St., New York, N. Y. 398 pps. \$12.00.

### **Plant Maintenance**

Seventh of a series and by far the broadest in scope to date is the 1956 edition of "Techniques of Plant Maintenance and Engineering", published by Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y., and priced at \$10. Containing the full text of 16 prepared talks on various maintenance problems, summaries of 15 round-table discussions, and answers to approximately 1100 specific questions on this same subject, this book represents a comprehensive report of accepted modern practices and it constitutes the full proceedings of the most recent national Maintenance Show and Conference, staged this year in Philadelphia.

Consisting of 248 pages sized 8-by-11 in., and illustrated by 110 drawings, charts and tables, the book covers such subjects as preventive maintenance practices, measuring the effectiveness of maintenance, equipment replacement policies, independent contractors, 24-hour operation of maintenance shops, cost control, inspection procedures, use of punched cards, electrical equipment, machine tools,



**TED LYNCH** is a project superintendent at B. B. Electrical Contractors Inc., Paterson, N. J., where a full staff of electrical construction specialists handles various types of outside construction and inside electrical work.



OUTLET BOX LAYOUT for stack lighting fixtures at the new Simon Cohen Library being constructed for the City College of New York is studied by engineer Morton Sagan (left) and electrical superintendent Jack Weber, both of Brown Electric Co., New York City electrical contractors.

report writing, relationships between maintenance and purchasing departments, forms and reports, tool room control and promotional suggestions for uniting all classifications of maintenance people to work together as a team to achieve maximum benefits for the plant.

Bound in red hard-board covers with gold lettering, this book is recommended as a fact-packed reference source for all supervisors or directors of this important function.

### How to Run a Small Business

Critical areas of successful management covered in this 2nd edition includes: fiscal controls and planning; financing procedures; insurance needs; credit and collections; and efficient office operation. Revisions—by Sydney Pereau—bring the book up to date, particularly with respect to present tax laws. By J. K. Lasser. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 332 pps. \$4.95.

## **Electric Heating Manual**

Step-by-step procedure for determining the precise requirements in any home according to its geographical location and its individual design are presented along with a brief outline on calculating operating costs. By Electric House Heating Equipt. Section, NEMA 155 E. 44th St., New York 17, N. Y. 24 pps. \$0.25.

# KOHLER Electric Plants for low-cost electricity where the work is done



Cut work time with your own portable electricity wherever, whenever needed. Save expense and delays of temporary powerline hook-ups. Kohler Electric Plants operate saws, drills, other power tools used in wiring jobs. Also models for stand-by protection—to maintain home, public or commercial electrical equipment when central station power is cut off. Sizes 500 watts to 35 KW. Write for folder M-19.

Model 2.5M25, 2500 watts, 115 volt AC. Manual starting.

Kohler Co., Kohler, Wisconsin . Established 1873

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PLUMBING FIXTURES . HEATING EQUIPMENT . ELECTRIC PLANTS AIR-COOLED ENGINES . PRECISION CONTROLS



● SLOTTED-NECK construction is an original ABolite development. It gives you a modern lighting fixture that stays cleaner longer, provides more up-light and results in longer lamp life by reducing the operating lamp temperature. You get better, less-glaring light, and maintenance is reduced to an absolute minimum.



● In addition to SLOTTED-NECK construction, ABOLITE lighting fixtures are available in ALL-WHITE finish, inside and out. This glass-smooth finish is the whitest titanium white porcelain enamel ever developed. It will not rust, or stain, is impervious to weather, grease, oil and fumes, and provides a modern, efficient appearance that

efficient appearance that compliments contemporary architecture.

These original ABOLITE features are yours at no extre cost.



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THE JONES METAL PRODUCTS CO.

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### Industrial Electricity— Vol. I

This 3rd edition of a standard engineering text and reference has been revised and updated to conform with current industrial practices in the generation, utilization and control of dc power. Both theory and application are presented; a well-organized index facilitates use as a reference. By Chester L. Dawes. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 431 pps. \$5.50.

### Farm Wiring Specifications

The successor to a previous REA book, this manual discusses service and circuit requirements of the farmstead, also equipment selection and installation methods. Suggested specification and contract forms are offered. By Farm Wiring Subcommittee, NEMA, 155 E. 44th St., New York 17, N. Y. \$0.25.

### New CU Formulas

The Illuminating Engineering Society has made available a 35-page booklet on "Calculating Coefficients of Utilization" for lighting, based on the Zonal-Factor Interflectance Method of computation which IES has adopted. Also available are Work Sheets 1, 11 & 111 at 5 cents per set. Booklet is 50 cents. Available from IES, 1860 Broadway, New York 23, N. Y.



GUSTAF MULLERT, one of the group of top-notch project superintendents handling specialized types of work for B. B. Electrical Contractors Inc., Paterson, N. J., is shown here checking over details on one of the jobs he heads up.







Minerallac Cable, Conduit and Messenger Hangers are STEEL. Easier, quicker to install; permit speedy, compact wiring; economical. Also in Everdur... Percalain Insulating Bushings available.

Jiffy STEEL Clips (Pipe-clamp) require only one screw, noil or bolt; rib-strengthened; for hanging pipe, canduit, BX cable, mounting cails, etc. Millions in use.

Steel Straps for Messenger-cable services on outlet boxes; may be used in conjunction with hangers.

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MINERALLAC

# Among the Manufacturers

#### **Headquarters Announcements**

Westinghouse Electric Corp., Pittsburgh, Pa.—A. J. Hendry, sales manager of the Standard Control Division.

Ruby Lighting Co. of Los Angeles, Calif. and Dallas, Texas has been purchased by the Ekco Products Co., Chicago, Ill.

Day-Brite Lighting, Inc. of California, Los Angeles—James F. Mahoney, president and general manager.

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.—O. B. Wilson, vice president of the Brown Instruments Division.

Electric Service Mfg. Co., Philadelphia, Pa. has been purchased by the H. K. Porter Co., Inc. of New York City. Sales operations will be combined with those of the parent company's Delta-Star Electric Division.

Oster Mfg. Co., Cleveland, Ohio
—Roger Tewksbury, chairman of
the board; T. S. Bonnema, president and general manager.

Thor-Power Tool Co., Aurora, Ill.

J. P. Bank sales engineer.

General Electric Co., Schenectady, N. Y.—Maynard W. Johnson, general manager of the Large Motor and Generator Dept.

Wakefield Co., Vermillion, Ohio

D. A. Schisler, assistant sales
manager.

Kelman Electric & Mfg. Co., Los Angeles, Calif.—has been obtained by the I-T-E Circuit Breaker Co. of Philadelphia, Pa. Harry L. Buck will be president of the new subsidiary.

U. S. Rubber Co., New York, N. Y.—H. N. Hawkes, member of the board of directors and member of the executive committee.

General Electric Co., Coshocton, Ohio—B. F. Brehl, manager—Industrial Laminate Sales.

#### **Regional Appointments**

#### MIDDLE ATLANTIC

Union Insulating Co.: D. W. Lawson, New York district manager.

Johns-Manville Corp.: James G. Walker, Northeastern regional sales manager of the Pipe Division with offices in New York City. C. G. Topping, New York area sales manager for the same division.

Gen-A-Matic Corp.: Harry



# happy ending

FOR ARMORED CABLE RUNS

# TERMINATORS from

PLM Type AC 600-v Terminator for armored cable

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Type ACS Terminator for installations to 15 kv



Type BAC Bracket for wall or ceiling mounting PLM

Planning is easy...installation easier...with armored cable fittings from PLM! PLM Terminators are made for installations to 15 kv...in cast aluminum or bronze...eliminate need for bulky, costly potheads in many applications. PLM Unit Package Kits speed up the job, too...insure correctly designed terminations and splices at every point.

Put PLM in your plans for quick action on both standard and special needs. Write for catalog.

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WIRE AND CABLE FITTINGS AND ACCESSORIES

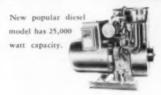
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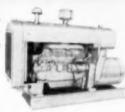
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Manufacturing Co.

Hanser, representative for coastal states from New York to Virginia. Headquarters in New York, N. Y.

Headquarters in New York, N. Y. McPhilben Lighting Co.: Robert Caldwell, Delaware representative.

Reliance Electric & Engineering Co.: W. L. Brehmer, manager of new Central Western New York district with offices in Rochester.

#### SOUTH ATLANTIC

Berko Electric Mfg. Corp.: G. L. Washington, Atlanta, representative for Georgia and eastern Tennessee; R. B. Shannon of Orlando will cover northern Florida, and J. B. Russell will service accounts in southern Florida from his offices in Boca Raton.

Cutler-Hammer, Inc.: B. R. Stratton, manager of the Atlanta, Ga. district sales office.

Diehl Mfg. Co. has opened a new Southern District office and warehouse at Chamblee, Ga.; E. F. Graham is manager.

Steel Electric Products Co.: Jules J. Dreyfuss & Sons, Atlanta, representatives for six southeastern states.

McPhilben Lighting Co.: J. A. Farmer, representative for southern Florida.

#### EAST CENTRAL

Clark Controller Co.: G. M. Piotrowski, district application engineer attached to the Chicago office.

Lightolier, Inc.: Leonard Elkan representative for eastern Ohio and adjacent portion of Pennsylvania; Ernest Lieberman, Akron and metropolitan Cleveland representative.

Thor Power Tool Co.: R. E.



ARTHUR N. REICHEL, president of New Jersey Electrical Engineering, Inc., Englewood, N. J., who has had extensive experience in electrical design in commercial and industrial buildings, especially in petroleum bulk storage plants, is shown here checking some details on an electrical modernization system.



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COMPLETE MODERNIZATION of the electrical facilities of New York City's Metropolitan Museum of Art is in its fifth year for Irving Schwartzberg, (left), general foreman for Eastern States Electrical Contractors, Inc., shown here with Eastern's job superintendent, Edward F. Geyer.

James, Jr., manager of new Indianapolis, Indiana branch.

Electro Silv-A-King Corp.: O. E. Barron, district manager of territory encompassing Louisiana, southern Mississippi, Mobile, Ala., and Pensacola, Fla. Headquarters in New Orleans.

Berko Electric Mfg. Co.: Alvin Eskin, representative for northern Illinois and southern Wisconsin.

Reliance Electric & Engineering Co.: F. E. Davis, manager of new office in Youngstown, Ohio,

Union Insulating Co.: F. V. Pieters, Chicago sales representative.

#### WEST CENTRAL

McPhilben Lighting Co.: Warren McFarlane, Oklahoma City, Texas and Oklahoma representative.

Reliance Electric & Engineering Co.: F. A. Dennison, manager of Gulf Coast district, offices at Houston, Texas; W. K. Schlotterbeck, Dallas district manager.

Lightolier, Inc.: Arthur Jones, representative for Colorado, Utah, Wyoming, eastern Idaho and Montana.

#### WEST

Clark Controller Co.: King D. Christopher, general manager of the new Los Angeles, California division including sales, engineering and production activities.

Sylvania Electric Products Inc.: Robert C. Harper, director of Pacific Coast sales. A new warehouse and sales office has been opened at 6505 E. Gayhart St. in Los Angeles.

Berko Electric Mfg. Co.: R. R. Prussia, San Francisco, sales representative for northern California and Nevada.

Lightolier, Inc.: Ronald Harston, representative for Washington, Oregon, western Idaho, Alaska and British Columbia.



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# SPEED SERVICE WITH SPECIAL TRUCKS

FROM PAGE 115

service unit. Further, he has equipped each unit with a two-way radio, so that the crew can be quickly dispatched to other jobs in its vicinity, in emergencies, without having to return to the shop. Mobile service units are available for complete 24-hour electrical service. Other typical design trucks are also used for special hauling requirements for which these special mobile service units are not suitable.

Dunn Electric Company offers a complete electrical contracting service, and in addition has a fully equipped service organization to handle all types of electrical installations, repairs and maintenance for the home, store, office and factory. Also, it maintains a complete line of lighting fixtures, lamps, radios, television sets and appliances.

Trucks may also be used for convenience as field project head-quarters—as an office for project supervision, storage of tools and equipment, etc.—as is done by Hale Electric Co., Inc., Pittsburgh, Pa. In their case a Wells Cargo 4-ton semi-trailer is used. A standard Model WC-2024 unit was purchased, and rebuilt to provide the features required by their operations.

The body length of this semitrailer is 20 ft (overall length 23 ft), overall height is 9 ft, and width is 7 ft. Interior height is 6 ft 8 in., and interior width is 6 ft 9½ in. Hale Electric took the bare shell and insulated the sides and



SERVO CONTROLS regulating speed of textiles through lace drying machine at the Thomas Wilson Co. Inc., lace manufacturers of Port Jefferson Station, New York, are studied during installation by V. J. Calandra (right), electrical contractor, and maintenance man Charles Heyer.

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ERWIN BUSCH, who with his brother Hans heads up operations of Busch Brothers, Inc., Englewood, N. J., wellknown electrical contractors throughout northern New Jersey, is an important contributor to the growth of his company and the electrical construction industry.

ceiling, and divided it into two 10-ft sections. The front half was equipped for office, with drafting table, file, plan rack and cabinet. The rear half was arranged as a storage area with bins, locked sections for special items, and folding seats for men which become covers for bottom bins when not in use by the men

Both sections of this trailer are heated with electric baseboard heating. Two 300-watt 5-ft strips were used to heat the rear section, and one 300-watt 5-ft strip was placed under the drafting table. The two sections are separated by a lockingtype sliding door of expanded metal for ventilation. Under the bins are compartments for storage of 10-ft sections of conduit, Wiremold, or other raceway.

Lighting is accomplished with five shallow (24-in.) 2-lamp 40watt fluorescent units, individually switched. The floor is linoleum. At the outside rear right are two watertight outlets for power tools. At the outside front right is a weatherproof junction box which connects to incoming service which can be mounted on a free-standing 4 by 4 post. Feed for an 8-circuit panel and telephone fish wire come in at the front, same location.

A low-slung hitch makes it easy to hook up this semi-trailer to a panel truck or to a passenger car, for moving from one project to another. William Reister, manager of Hale Electric's maintenance department, states that this unit has proved to be quite practical and satisfactory, and that they are highly pleased with it.

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# EMERGENCY ELECTRICAL SERVICE

[CONTINUED FROM PAGE 117]

to operate the generators in parallel for testing or to serve a single remote load (isolated from normal hospital service) it is possible to remove a link in the bus between generator breakers and the low-voltage power-center bus. This would permit the use of two segregated buses for separate emergency operation without disturbing normal service to other areas in the hospital.

Testing of equipment under simulated conditions of an actual primary outage can of course be performed by opening the load-break switch on the primary side of the transformer, thereby deenergizing the 4800-volt service completely and initiating the full automatic transferring cycle.

Circuit breakers may be either electrically or manually operated, all automatic control equipment as well as manual closing and synchronizing features being mounted on a common hinged instrument panel to facilitate operation.

Sensitive hydraulic governors for diesel engines and equally-sensitive voltage regulators for generators assure load division within 10% of a generator's full-load rating under parallel operation with minimum current circulation. Engine speed droop is set at approximately 2%, this setting having been found to provide fast synchronizing while assuring good load division. With generators arranged to assume load automatically, the first machine to reach rated voltage and frequency picks up the load, then immediately slows down by the amount of its governor droop. The second generator, also accelerating during this same interval to its maximum noload speed, remains within synchronizing limits of the automatic synchronizing device (set at 3% maximum). This setup presented initial problems, until proper limits for fast and positive synchronizing were determined through the trialand-error method.

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and radiators, and utilizing an electric booster pump on the fuel feed line. Maintaining these conditions results in consistent starting times of less than six seconds.

It was initially found that the field-forcing action of the voltage regulator boosted the generator almost up to rated voltage before the engine was beyond 1-normal speed, and that the frequency-check relays prevented picking up load before 60 cycles were obtained. This combination of synchronizing surges, plus field-forcing action of regulators before generator excitation could assume a steady condition, occasionally reversed the polarity of one of the exciters. This resulted in erratic regulator performance during parallel operation.

It was eventually determined that the 120-volt exciter field was working at a relatively low excitation, resulting in operation in a relatively unstable portion of the saturation curve. It was also determined that, during synchronization, excitation could be forced through zero, ove coming exciter residual magnetism with resultant reversed polarity. These problems were eliminated by the insertion of a fixed resistor between the exciter armature and generator field, thereby boosting the exciter field voltage to a more normal value.

Since installation of this emergency generating equipment, test procedures have been scheduled weekly. This is accomplished by opening the high-voltage load-break primary switch, thereby simulating a complete utility failure. Engine generators are then started and paralleled to assume the load for approximately 15 minutes. The transformer high-voltage switch is then reclosed, normal utility service is restored, and engines are automatically cut out of service.

With present-day planning of public buildings contemplating the possible occurrence of a major catastrophy, this system of paralleling diesel generators for emergency service is receiving considerable attention around Los Angeles. Therefore, in addition to the two installations herein discussed (County of Los Angeles Contagious Diseases Hospital, and the Post Polio Hospital at Rancho Los Amigos in Downey), similar installations are likewise being installed in the new Courts Building and new Osteopathic Unit of the General Hospital, both in Los Angele:.

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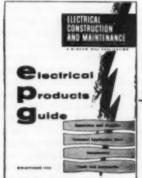
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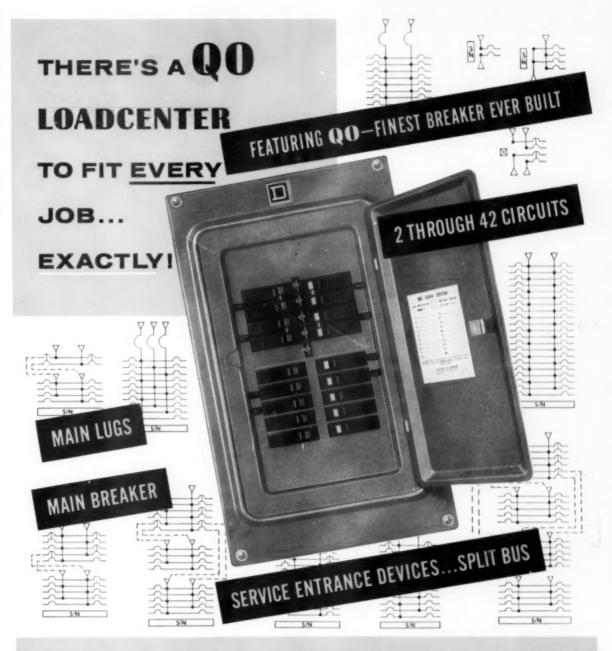
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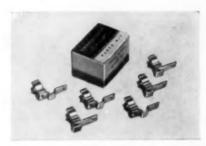
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